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A LINGUISTIC ANALYSIS OF SOCIAL STUDIES TEXTS

BY

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The undersigned certify that they have read,  
and recommend to the Faculty of Graduate Studies for  
acceptance, a thesis entitled A LINGUISTIC ANALYSIS OF  
SOCIAL STUDIES TEXTS submitted by Terese G. Cossitt in  
partial fulfilment of the requirements for the degree  
of Master of Education.





## ABSTRACT

This was an exploratory study which attempted to utilize a special linguistic technique in order to examine sentence complexity in high school social studies textbooks. Sentence complexity has been empirically determined to be a contributor to the difficulty of understanding written discourse and some measure of sentence complexity has been included in many readability formulae. However the effectiveness of techniques utilized in past studies to examine sentence complexity is open to further consideration.

An investigation of Chomsky's theory of transformational grammar indicated that this theory might provide a valuable method for examining sentence complexity since it provides an explicit description which reveals and expresses the basic regularities of the language. This theory of language provided the rationale for an examination of noun modification and a determination of the frequency of occurrence of structures of noun modification in textbooks.

Chomsky's theory of grammar illustrates the fact that nearly all noun modifiers in English are either relative clauses or derive from the relative clause construction. Grammatical complexity can be determined by the number of rules required to produce a modification unit from two or more source sentences. In addition this grammar shows the syntactical as well as the functional relationship that exists among noun modification structures.

A primary and secondary social studies text at grades ten,



eleven, and twelve levels were examined in order to determine how frequently selected noun modifiers appeared in the texts. These modifiers were assigned a syntactic description in terms of Chomsky's grammar.

All of the predetermined modification units were found in the texts with varying degrees of frequency. The prenominal adjective, one of the most deeply embedded structures, was the structure that appeared most frequently in all texts. Since the prenominal adjective is one of the most complex grammatical structures in noun modification, there is the suggestion that it might be the most difficult structure to comprehend. However frequency is not necessarily equated with difficulty since the factor of redundancy could perhaps compensate for complexity.

The relative clause, the prepositional phrase, the participial phrase, the participle, the appositive noun phrase, and the phrase with an initial adjective followed in frequency of occurrence. The infinitive phrase, the appositive adjective, and the adverb of place were structures that were used less frequently or not at all as noun modifiers. The secondary texts at all grade levels contained more modification units than did the primary texts. Grade twelve texts were found to be the most complex grammatically in terms of noun modification since they contained the highest percentage of the more deeply embedded structures.

It was concluded that the use of Chomsky's model of a







transformational generative grammar is an effective tool for identifying and describing syntactical elements and for expressing the relationship that exists among various units.

This study has shown that at least ten different syntactic patterns may be used to express noun modification and there is variation in these patterns in terms of length, complexity, position, and frequency of occurrence. This finding suggests that predicting difficulty of written discourse by sentence length is perhaps too unsophisticated a procedure to yield valid results.

Suggestions were made for an examination of other patterns of syntax not included in this study and for an extension of this kind of analysis to all types of textbooks. The results of these examinations could possibly lead to the development of a readability formula that includes patterns of syntax as a predictor of difficulty. This theory of grammar might also be an excellent device for attacking prose style. In addition it is suggested that this form of grammar could make considerable contributions to the teaching of English and in helping students to comprehend written discourse.



## ACKNOWLEDGEMENTS

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## CHAPTER I

### I. STATEMENT OF THE PROBLEM

The selection of books to be used as teaching materials is one of the major decisions that teachers, administrators, and curriculum planners have to make. The reading level of written instructional material is an important factor to be considered in making these decisions. Many teachers have expressed concern about the difficulty that students experience in attempting to comprehend written material as it is presented in their textbooks. Yoakam is of the opinion that a considerable proportion of youngsters in school are frustrated because of the difficulty of the instructional materials used with them.<sup>1</sup>

The problem of evaluating the difficulty of written discourse has many dimensions and poses many problems. A considerable amount of research has been devoted to finding the factors that make a book readable. These factors have been examined within the broad areas of content, style, and legibility which utilize interest, ease of understanding, and speed of understanding respectively as the criteria for the readability of printed material. Dale and Chall point out that

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<sup>1</sup>Gerald A. Yoakam, "Why Readability is a Problem for Teachers," Readability: Finding Readable Material for Children, ed. Gerald A. Yoakam (A Report of the Tenth Annual Conference on Reading Pittsburgh, Pennsylvania: University of Pittsburgh Press, 1954), p. 11.





although the choice of subject matter and factors of format can affect comprehension, readability as "comprehensibility" has been examined mainly in the area of style.<sup>2</sup>

The most significant stylistic factors that have been empirically determined as contributors to reading ease or difficulty have been incorporated into numerous readability formulae. These formulae may be used to give an estimate of difficulty in terms of a rating such as grade placement. To date there is no formula that incorporates factors of content, style, and legibility in order to determine the approximate difficulty of written material. Although many factors have been considered for inclusion in these formulae, only two, vocabulary and some measure of sentence complexity, have been consistently employed to predict difficulty. Although vocabulary and sentence complexity are significantly related to difficulty, the contribution of each to difficulty has not been fully determined. The present study will give further consideration to the factor of sentence complexity.

The measure of sentence complexity most often utilized has been sentence length and this has been done in terms of average number of

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<sup>2</sup>Edgar Dale and Jeanne S. Chall, "The Concept of Readability," Readability: A Publication of the National Conference on Research in English (Champaign, Illinois: National Council of Teachers of English, 1949), p. 4.



words per sentence.<sup>3</sup> There are many syntactical patterns that contribute to length. Are they all equally difficult to comprehend? Little is known about the patterns of syntax that are found in textbooks, particularly at the high school level, and the ability of pupils to cope with them is a matter of conjecture. Isolating the various syntactical patterns found in textbooks would be the first step toward determining the ability of pupils to deal with them.

## II. PURPOSE OF THE STUDY

The purpose of this study is to utilize Chomsky's model of a transformational-generative grammar to examine some linguistic aspects of social studies textbooks at the high school level. The analysis will consist of syntactic descriptions of certain structural elements whose presence in sentences contributes to sentence length.

Traditionally, sentences are described in terms of a subject, which must contain a noun or a noun substitute, and a predicate, which must contain a verb and which may contain a noun or a noun substitute. Nouns, therefore, are important in that they appear in the two essential parts of a sentence. In addition, nouns are heavy carriers of meaning and are one category of words that are considered key words in a sentence. Any word, phrase, or clause that elaborates, limits,

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<sup>3</sup>Jeanne S. Chall, Readability: An Appraisal of Research and Application (Bureau of Education Research Monographs, No. 34. Columbus, Ohio: The Bureau of Educational Research, Ohio State University, 1958), p. 55.





or qualifies a noun is therefore an important structure by virtue of being associated with a noun. The relative clause is a structural element that modifies a noun. In English syntax most noun modifiers, whether in prenominal or postnominal position, derive from the relative clause. These constructions are: prenominal adjectives, participles, participial phrases, infinitive phrases, prepositional phrases, phrases with an initial adjective, appositive noun phrases, appositive adjectives, and adverbs of place. These constructions may be shorter in length than the relative clause but because they derive from the relative clause they are more deeply embedded in the sentence. The question arises as to whether it is length and/or depth of embedding that contributes to difficulty.

Chomsky's model of a generative grammar will be used to provide the structural description. This model of language is selected because it attempts to formulate precisely the processes of sentence formation that constitute the linguistic competence of the fluent speaker and that underlie the actual use of the language. Chomsky's theory of grammar provides a syntactic description that shows that most noun modifiers derive from the relative clause. The application of one rule will produce the relative clause and the application of two and three rules will produce the remaining modifiers. This is the only theory of grammar which formulates precisely the processes by which these modifiers are embedded in sentences and which shows the relationship of these elements to one another and to source sentences.



### III. PLAN OF THE STUDY

In this study, a primary and a secondary text authorized for social studies at grades ten, eleven, and twelve levels were selected for examination. Beginning with the first page, samples of approximately one hundred words were selected from every tenth page of the text. All the sentences in the sample were counted. A separate count was taken of every sentence that contained one or more noun modifiers. The frequency of occurrence of each modifier was also recorded. Each noun modifier was assigned a structural description in terms of Chomsky's grammar. The data provided by the analysis were graphed to show the percentage of sentences in selected samples in social studies texts at the grade ten, eleven, and twelve levels that contained noun modifiers that were relative clauses or that derived from the relative clause.

### IV. DEFINITION OF TERMS

A grammar is a device that generates all of the grammatical sequences of a language and none of the ungrammatical ones.

The rules of grammar are a limited set of directions for producing or generating the grammatical sequences of a language.

A sentence in terms of a transformational-generative grammar is defined by an extensive set of statements that constitute the whole grammar. The definition of a sentence for the purpose of sentence selection from the texts used in this study is as follows:





A sentence is that part of written discourse that extends from a capital which appears after a period, a question mark, or an exclamation mark to a period, a question mark, or an exclamation mark, which immediately precedes a capital letter.

Basic sentences are the simple, declarative, active sentences of the language. They contain no complex noun or verb phrases. They are basic in the sense that their subparts are not other sentences, but are formed of a sub-part called a noun phrase and another sub-part called a verb phrase.

Example: The boy / is sick.  
                   NP                  VP

Transformed sentences are alternate forms of basic sentences. When these sentences take the form of inversions, questions, imperatives, negatives, or emphatics, they are known as simple transforms. When two or more basic sentences are combined into a single sentence statement the result is called a complex or conjunctive transform.

Example: Who is the boy? (simple transform)

The boy who is with me is my brother. (complex transform)

A matrix sentence is any basic sentence that accepts some other sentence as one of its sub-parts.

An insert sentence is any basic sentence that enters some other basic sentence as one of its sub-parts.

Example: The boy who works here is my cousin consists of the two basic sentences The boy is my cousin and The boy works here.



The boy is my cousin is the matrix sentence since it accepts The boy works here which becomes a sub-part who works here. The boy works here is an insert sentence since it enters another sentence as one of its sub-parts.

A clause is a group of words that contains a verb and its subject.

A relative clause is a subordinate adjective clause that is introduced by a relative pronoun, a relative adjective, or a relative adverb. There are two kinds of relative clauses - restrictive, in which the relative directly follows the noun, and nonrestrictive, in which the relative is separated from the noun by a comma or comma intonation.

Example: A pen that leaks is a nuisance. (restrictive)

Dr. Scott, who is my teacher, retired this year.  
(nonrestrictive)

An adjective clause is a subordinate clause that functions as an adjective by modifying a substantive in the main clause. An adjective clause may be introduced by a relative pronoun, a relative adjective, a relative adverb, or by a preposition and a relative.

Example: The man who wrote the paper is here.

A phrase is a group of related words that lacks a subject and predicate and is used either absolutely or as a single part of speech.

Example: Crying bitterly, the boy passed by. (participial phrase used absolutely).

We went into the building. (prepositional phrase used as an adverb).





An adjective phrase is a phrase that functions as an adjective by modifying a substantive. It differs from an adjective clause in that the phrase lacks a subject and a predicate. An adjective phrase may be any one of several kinds: a prepositional phrase, a participial phrase, or an infinitive phrase.

Example: The coat on top of the pile is mine.

A participle is a nonfinite verb form that may help form certain verb phrases or function as an adjective.

Example: Mary has written an essay. (participle used as part of a verb phrase).

Smoking ruins remained. (participle used as an adjective).

A participial phrase is a phrase that consists of a participle, its modifier(s) and/or complement(s). When a participle modifies a substantive it is used as an adjective.

Example: The boy delivering groceries is my brother.

A prepositional phrase is a phrase that includes the preposition, its object or objects, and any modifiers or connectives that may be present. When it modifies a substantive it is used as an adjective.

Example: The man on the beach is a good swimmer.

An infinitive phrase is a phrase that consists of the infinitive with the to stated, the object and/or any modifiers that may be present. When it modifies a substantive it is used as an adjective.





Example: Her attempt to win the race was laudable.

An appositive adjective is an adjective that follows the substantive that it modifies.

Example: The boys, hungry, dirty, and tired, plodded home.

An appositive noun phrase is a noun phrase that follows the substantive that it modifies.

Example: The boys, baseball players of note, were at the banquet.

## V. LIMITATIONS OF THE STUDY

This study is not concerned with seeking a readability formula for high school textbooks but rather with a descriptive analysis of certain syntactic structures found in these texts and the determination of the frequency of occurrence of these structures in a selected number of texts.

The types of structures examined are limited to those elements that function as modifiers of nouns. The examination is further limited to selected noun modifiers that are relative clauses or that derive from the relative clause.

The examination of texts is limited to one primary and one secondary social studies text from each of grades ten, eleven, and twelve that have been authorized by the Department of Education for the Province of Alberta.



## VI. SIGNIFICANCE OF THE STUDY

It has been pointed out by Ruddell that although the inclusion of average sentence length, the number of prepositional phrases, the number of simple sentences and other elements of language structure have been shown to affect reading difficulty, the amount of variance accounted for by these factors has been relatively negligible. The specific factors considered in readability prediction have accounted for only 26 to 51 per cent of the variance in the comprehension scores.<sup>4</sup> Ruddell suggests that "either factors of language structure are unimportant in relation to reading difficulty or the techniques utilized in the past studies have not effectively measured the contribution of language structure to reading difficulty."<sup>5</sup> The use of a theoretical model of grammar should provide a more effective technique than has been employed in the past.

Strickland states that the material which one reads is composed of words set forth in certain structural arrangements which are fully as much carriers of meaning as are the words themselves. One aspect of Strickland's investigation of language development in elementary school children involved a comparison of syntactic patterns used by

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<sup>4</sup>Robert B. Ruddell, "The Effect of the Similarity of Oral and Written Patterns of Language Structure on Reading Comprehension," Elementary English, IV (April, 1965), 404.

<sup>5</sup>Ibid.





elementary school children and the patterns found in basal readers. One of the suggestions that Strickland makes as a result of this analysis is that consideration be given to the inclusion of tests of difficulty of patterns of syntax in formulae for measuring readability.<sup>6</sup> However, before this can be done, some method that does not rely on subjectivity or intuition must be found so that an analysis can be carried out. Chomsky's method of syntactic analysis provides such a method.

Linguists have frequently been accused of ignoring meaning in providing descriptions of language. This is true in one sense; the linguist insists that a sentence can be analyzed in terms of its structure without any reference to meaning. However Chomsky believes that the process of 'understanding' a sentence must be partially analyzed in grammatical terms.<sup>7</sup> He states:

To understand a sentence it is necessary to reconstruct its representation on each level, including the transformational level where the kernel sentences underlying a given sentence can be thought of, in a sense, as the 'elementary content elements' out of which the sentence is constructed. In other words, one result of the formal study of grammatical structure is that a syntactic framework is brought to light which can support semantic analysis.<sup>8</sup>

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<sup>6</sup>Ruth G. Strickland, The Language of Elementary School Children: Its Relationship to the Language of Reading Textbooks and the Quality of Reading of Selected Children (Bulletin of the School of Education, Indiana University, XXXVIII:4, July, 1962), pp. 103-104.

<sup>7</sup>Noam Chomsky, Syntactic Structures (The Hague: Mouton & Company, 1957), p. 92.

<sup>8</sup>Ibid.





An analysis of the syntactic structures present in the textbooks used by high school students should give some new insights about the contribution that stylistic features make to reading ease or difficulty.

This study is significant in that the use of Chomsky's model of a transformational generative grammar allows for a more rigorous examination of some factors that have been established as determinants of reading ease or difficulty. This form of grammar is more rigorous and more powerful than a traditional grammar in that the explicit description it provides shows not only the functional relationship but also the syntactical relationship that exists among various sentence elements.

## VII. OVERVIEW OF THE STUDY

The remainder of this study is presented in Chapters II, III, IV, V, and VI according to the following plan.

Chapter II reviews some of the research that has focused on factors of style as determinants of reading ease or difficulty. A review of investigations that have utilized a theory of language in order to gain insights into the developmental aspects of spoken language and to formulate hypotheses about verbal behaviour is also included. Chapter III discusses the aim of scientific language description and outlines Chomsky's theory of transformational-generative grammar. The procedure followed in obtaining the data and the method of analyzing the structures pertinent to the study are given in Chapter IV. Chapter V deals with the interpretation of the data and Chapter VI gives a summary of the findings, conclusions, and implications for further research.



## CHAPTER II

### REVIEW OF THE LITERATURE

The problem of determining the difficulty of written discourse in relation to comprehension has received considerable attention during the past forty years. Much of the literature on the subject has revolved around the development of readability formulae. A number of these studies have included elements of language structure among the comprehension variables investigated. In addition, a number of studies have specifically investigated elements of language structure as variables affecting comprehension difficulty. Some attempts have also been made to test the validity and efficiency of the 'cloze' procedure as a measure of difficulty.

Until recently however, readability research (whether or not it culminated in the development of a readability formula) has been hampered by the lack of an adequate tool for the analysis and study of language. Although the great advances made by linguistic theory and practice in recent times have led to a number of interesting attempts to apply new knowledge to problems in a variety of related fields, to date this knowledge has not been applied to readability. A precise consideration of the organization of language structure has been confined mainly to investigations dealing with the development of oral language in pre-school and elementary school children. In some





instances these studies have utilized Chomsky's model of a generative grammar as a technique in attempting to characterize the language of children. In addition, Chomsky's theories have proved a major stimulus to psychologists who are interested in investigating the psychological processes involved in linguistic knowledge and behaviour.

The literature examined in connection with this study is divided into three parts. The first section deals with a number of investigations that have been reported during the past forty years that have examined elements of language structure in textbooks and other materials in order to determine reading ease or difficulty. These studies are cited in order to give a background of the kind of analysis that has been applied to textbooks so often in the past.

The second section examines a number of studies that have been produced during the past few years which utilize some method of linguistic analysis, including Chomsky's model of syntactic structures, to examine the spoken language of children. In some instances an analysis of textbooks at the elementary level has been included as part of the study. However this type of analysis has not been extended to include the upper levels. These investigations are considered pertinent to this study because they illustrate the contribution that a theoretical framework provides in a linguistic analysis. They are also valuable in that they record the structures used by children in oral speech thus making possible a comparison with the structures found in text books, once they have been isolated, to determine what correlation, if any, exists.





The third section deals with a number of studies that have utilized Chomsky's model of language as a theoretical framework within which a number of hypotheses have been formulated in order to show the psychological significance of syntactic structures. These studies are considered pertinent to this study because they offer some new and different insights into cognitive activity and how sentences are understood.

### I. READABILITY STUDIES

Dale and Chall<sup>1</sup> point out that there are three broad categories within which the research on readability may be classified. These are 1) typography, 2) content and its effect upon interest, and 3) factors of style and expression. The research analysed in this section will deal with the third aspect of readability since it is within this area that elements of language structure have been examined in order to determine the ease or difficulty of written material.

In 1958 Chall<sup>2</sup> produced a comprehensive summary of the research on readability and noted that attention has been focused for the most

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<sup>1</sup>Edgar Dale and Jeanne S. Chall, "The Concept of Readability," Readability: A Publication of the National Conference on Research in English (Champaign, Illinois: National Council of Teachers of English, 1949), p. 2.

<sup>2</sup>Jeanne S. Chall, Readability: An Appraisal of Research Application (Bureau of Educational Research Monographs, No. 34. Columbus, Ohio: The Bureau of Educational Research, Ohio State University, 1958), pp. 156-158.





part on one or more of the following factors; some simple or complex measure of vocabulary, sentence length, number of prepositional phrases, number of pronouns, number of affixes, and number of syllables per hundred words. The importance of vocabulary as a determinant of ease or difficulty of written material is evident in the utilization of some measure of vocabulary by the authors of all readability formulae and the comparatively high correlation coefficients which have been found between vocabulary knowledge and reading comprehension. However, Ruddell<sup>3</sup> points out that only three factors in sentence structure have been effectively utilized in predicting readability through incorporation into readability formulae and lists these components as (1) number of simple sentences, (2) number of prepositions or prepositional phrases, and (3) average sentence length. Among these components the average sentence length has been most consistently used, and in combination with some measure of vocabulary, has produced the highest reported prediction of readability of written material.

The first readability study that investigated the structural elements of language in addition to vocabulary was directed by Vogel and Washburne.<sup>4</sup> They listed seven hundred library books that had been

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<sup>3</sup>Robert B. Ruddell, "The Effect of the Similarity of Oral and Written Patterns of Language Structure on Reading Comprehension," Elementary English, IV (April, 1965), 403.

<sup>4</sup>Carlton W. Washburne and Mabel Vogel, "An Objective Method of Determining Grade Placement of Children's Reading Material," Elementary School Journal, XXVIII (January, 1928), 373-381.





named by at least twenty-five out of thirty-seven thousand children as being the ones they had read and liked during the year. The grade rating given to each book was the average reading score on the paragraph meaning section of the Stanford Achievement Test obtained by the children who read and liked it. The titles of the seven hundred books, together with the grade rating of each book and a short description of its content, were published as the Winnetka Graded Book List.<sup>5</sup> In order to obtain a grade rating on books not included in the original seven hundred, Vogel and Washburne continued their investigation by a search for an empirical and objective method for classifying books. From the Winnetka list they selected 152 books for examination and attempted to relate their grade placement index to some features or characteristics in the books. They selected ten factors which they considered were indicative of the structural difficulties in a text. Since previous research had shown that vocabulary was related to difficulty they included factors of vocabulary in their examination. They also investigated such factors as the kinds of sentences used, length of sentences, and number of prepositions as predictors of difficulty. The ten factors were reduced to four for inclusion in a formula. These were: 1) number of different words in a sample of 1000, 2) number of prepositions per 1000, 3) number of words not in Thorndike's list, and 4) number of simple sentences in 75 sample

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<sup>5</sup> Carlton W. Washburne and Mabel Vogel, Winnetka Graded Book List (Chicago: American Library Association, 1926), 286 pp.



sentences. A multiple correlation of .845 was obtained between these factors and the grade placement criterion.

The Vogel and Washburne formula was the prototype of modern readability formulae. Subsequent readability formulae were developed by relating a criterion and some internal indications of expressional difficulty. Any departure from the formula was mainly in the nature of the criterion.

The first study to utilize a different criterion was carried out by Ojemann.<sup>6</sup> Whereas Vogel and Washburne had used the median paragraph-meaning score of students who had read and liked a book, Ojemann in his investigation determined reading level by administering a test of comprehension on the material under consideration. The material consisted of 16 passages taken from adult magazines. The difficulty of the passages was determined by using a standardized test and the corresponding reading grade equivalent with adult subjects who were able to answer correctly at least 50 per cent of the comprehension passages.

Ojemann examined fourteen quantifiable factors which consisted of six vocabulary factors and eight sentence structure factors. The

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<sup>6</sup>Ralph Ojemann, "The Reading Ability of Parents and Factors Associated with the Reading Difficulty of Parent Education Materials," *Researches in Parent Education*, II, pp. 11-32, cited by Jeanne S. Chall, Readability: An Appraisal of Research Application (Bureau of Educational Research, Ohio State University, 1958), pp. 21-22.





sentence structure factors included the number of simple sentences, the number of dependent clauses, the number of prepositions, and the number of prepositions plus infinitives. The fourteen factors were correlated with the established criterion and all were found to be significantly related. Ojemann did not develop a readability formula although he did order his passages from easy to difficult so that they could be used as samples representing degrees of difficulty on the basis of the comprehension measure. However, his study included statistical information on the four most significant factors which were 1) the number of simple, compound and complex sentences, 2) the number of prepositions, 3) the proportion of words in dependent clauses, and 4) the average difficulty of different words.

Dale and Tyler investigated the relationship of structural factors and vocabulary with reading comprehension of adults having limited reading ability. Their criterion consisted of 74 passages related to personal health. The difficulty of the passages was determined by reading-comprehension tests constructed on the passages and taken by adults of limited education. They examined 29 factors and found 10 of these to be significant. However these were reduced to the following three: (1) number of different technical words,

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<sup>7</sup>Edgar Dale, and R.W. Tyler, "A Study of the Factors Influencing the Difficulty of Reading Materials for Adults of Limited Reading Ability, "Library Quarterly, IV (July, 1934), 384-412.





(2) number of different hard non-technical words, and (3) number of indeterminate clauses. These factors were combined into a regression equation to predict the proportion of adults of limited reading ability (Grades III to V) who would be likely to comprehend the material. The three factors gave a multiple-correlation coefficient of .511 with the actual difficulty of comprehension as shown by the tests.

In 1934 Gray and Leary<sup>8</sup> published a study that was the most comprehensive in readability to be produced up to this time. They began their study by first making a survey to determine what factors contributed to readability. They asked a group of librarians, publishers, and teachers for their opinion on what they considered made a book readable. These judges considered factors of content, style, format, and organization to be the most important. The opinions of adult library users showed agreement. However, the latter group considered style of expression to be the most significant factor, and content to be the second most important factor.

These researchers investigated 82 factors in 48 reading selections and administered comprehension tests over the material to approximately 800 adults. Five factors were found to give the highest prediction of reading difficulty. These were (1) the number of prepositional phrases, (2) the average sentence length in words,

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<sup>8</sup>William S. Gray and Bernice E. Leary, What Makes a Book Readable (Chicago: University of Chicago Press, 1935), 358 pp.





(3) the number of words not included in the Dale list of 769 easy words, (4) the number of personal pronouns, and (5) the percentage of different words. A multiple correlation of .64 was found between these factors and the criterion of comprehension difficulty. The results of their research also indicated that for poor readers vocabulary measures appeared to be the most important but for good readers elements relating to sentence length and structure showed higher correlation coefficients with comprehension than did vocabulary measures.

Up to the time of Gray and Leary the research in readability was concerned with a search for an increasing number of factors that would be significant in the prediction of difficulty in reading materials. The work on readability after this period was characterized by a search for a simple, empirical formula that would predict difficulty in terms of grade level.

In 1938 Lorge<sup>9</sup> produced a formula that reduced all the previous factors considered to only three elements. These were (1) the number of different hard words, (2) the average sentence length, and (3) the number of prepositional phrases. The comprehension criterion used consisted of the grade-level score for a group of readers who answered correctly one half of the questions over 376 selections from the McCall-Crabbs Standard Test Lessons in Reading materials. A multiple-cor-

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<sup>9</sup>Irving Lorge, "Predicting Readability," Teachers College Record, XLV (March, 1944), 404-419.





relation coefficient of .766 was obtained between these factors and the comprehension criterion.

From the early nineteen forties and into the late nineteen fifties, the work of Rudolf Flesch received wide popularity. During these years he produced several readability formulae. Prior to his work the term 'readability' was confined largely to educational circles. However Flesch, through a series of articles and books, brought the concept of readability to the attention of many writers in journalism, business and government. It was largely due to his efforts that readability became a factor to be considered in most areas of mass communication.

In devising a readability formula Flesch<sup>10</sup> accepted the findings of other investigators that sentence length was an important factor in readability and included it in his formula as being a better indicator of difficulty at upper levels than vocabulary. He also included in his formula a personal reference count and an affix count as a factor designed to measure abstractness. He considered that an affix count was a measure of abstractness because the correlation between affixes and abstract words in the McCall-Crabbs passages was .78. The comprehension criterion consisted of the grade level equivalent of subjects who answered one half of the test questions over the McCall-Crabbs Standard Test Lessons in Reading materials.

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<sup>10</sup>Rudolf Flesch, "A New Readability Yardstick," Journal of Applied Psychology, XXXII (June, 1948), 221-233.



A correlation coefficient of .74 was obtained between these factors and the comprehension criterion. As an outcome of some difficulties presented by the factors included in this formula, notably the difficult and time-consuming affix count and the unclarified definition of the reference count, Flesch developed two new formulae.<sup>11</sup> One was for Reading Ease in which the old affix count was replaced by a syllable count which he considered to be also a measure of abstraction since it correlated .87 with the old affix count. The second was a Human Interest formula which was based on his original personal reference count.

Dale and Chall<sup>12</sup> devised a formula which was designed, as Flesch's revisions had been, to correct certain shortcomings in the original Flesch formula, one of which was the unreliability of the affix count. They hypothesized that a more efficient formula could be developed using only a word factor and a sentence factor. The sentence factor consisted of average sentence length. They also utilized the McCall-Crabbs Standard Test Lessons in Reading as the comprehension criterion. The average sentence length correlated .468 with the comprehension criterion. A multiple correlation coefficient of .70 was obtained between the two factors and the comprehension criterion.

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<sup>11</sup>Ibid.

<sup>12</sup>Edgar Dale and J.S. Chall, "A Formula for Predicting Readability," Educational Research Bulletin, XXVII (January, 1948), pp. 11-20, 28.







Although a considerable amount of research has gone into the quantitative approach toward readability, the usefulness of the various formulae developed requires an understanding of their limitations. In most of the formulae the kinds of books or passages analyzed put restrictions on the generality of application. Lorge points out that "the readability formula can only be applied to books like those evaluated in the course of its development."<sup>13</sup> The Winnetka formulae was based on children's books. Other formulae used adult materials. Dale and Tyler worked in a specialized area and used only health materials. A number of researchers used the McCall-Crabbs tests which are children's exercise type reading material. Chall<sup>14</sup> states that the application of these formulae must, if a strict scientific standard is to be maintained, be on material similar to the criterion on which it is based.

There are many factors that contribute to difficulty of a book. However readability formulae consider only structural difficulty. Factors of content, organization and conceptual difficulty are not included in any formula. Furthermore no consideration is given to the experience and motivation of the reader.

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<sup>13</sup>Irving Lorge, "Readability Formula - An Evaluation," Readability: A Publication of the National Conference in Research English (Champaign, Illinois: National Council of Teachers of English, 1949), p. 9.

<sup>14</sup>Jeanne S. Chall, Readability: An Appraisal of Research Application (Bureau of Educational Research Monographs, No. 34. Columbus, Ohio: The Bureau of Educational Research, Ohio State University, 1958), p. 35.



While the tested comprehension difficulty appears to be the best possible criterion there is a weakness inherent in the procedure. Lorge<sup>15</sup> states that the difficulty measure for a test is tied to the quality of the questions used to appraise it. The difficulty of a passage can be underestimated if easy questions are set for a difficult passage.

Readability studies have shown that sentence length and vocabulary contribute to difficulty and most formulae include these two factors. Short words can be abstract and a word can be easy or difficult according to its distribution in a sentence. However, readability formulae which are based on word lists or word length do not consider these aspects of vocabulary. Short sentences can be written in an atypical style and this material could be difficult to comprehend. Even though average sentence length is a known contributor to difficulty and is included in many formulae there are many aspects of language structure that have not been considered. There are many syntactic patterns that contribute to length but readability formulae do not include various syntactic patterns as predictors of difficulty. Sentences have been considered in terms of simple, compound, and complex. However sentences may be categorized in other ways, for example, active, passive, question, negative and combinations of these types. In addition, there are many ways to state negative and question sentences in English. No readability studies have examined sentences in these forms.

It is possible that the results obtained from the use of formulae based on the assumption that discourse that contained polysyllabic words

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<sup>15</sup>Lorge, op. cit., p. 11







and long sentences is more difficult to read than discourse based on short words and sentences may be misleading.

In order to counteract these limitations, Klare<sup>16</sup> points out that the 'cloze' technique, which utilizes the factor of redundancy rather than short words and sentences has also been used to assess readability. A 'cloze' test samples the reader's ability to predict "what word comes next" at randomly selected points in the article. The assumption underlying the use of this factor is that a highly redundant article should be easier to read.

Bormuth<sup>17</sup> investigated the 'cloze' procedure as a measure of readability. A set of nine short passages was written so that there were three in each of the subject matter categories of literature, social studies, and science. Within each category passages were written at the 4.5, 5.5 and 6.5 readability levels. Readability levels were computed by the use of the Dale-Chall formula. A correlation of .92 between cloze and multiple-choice rankings was obtained. The reliability of the 'cloze' rankings was very high as indicated by almost perfect correlations between rankings of the same material at three different grade levels. He concluded that the 'cloze' tests were valid predictors of the readability of the passages from which they were made.

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<sup>16</sup>George R. Klare, The Measurement of Readability (Ames, Iowa: Iowa State University Press, 1963), p. 172.

<sup>17</sup>John Robert Bormuth, "Cloze Tests as Measures of Readability and Comprehension Ability" (unpublished Ph. D. thesis, Indiana University, 1962), 195 pp.



In addition to studies that have included sentence factors as determinants of difficulty in written material there have been a number of investigations that have considered only elements of language structure in attempting to assess the difficulty of written material.

McClusky<sup>18</sup> developed comprehension tests utilizing material from the areas of fiction, sociology, political science, economics, psychology, and physics in order to determine the effect of the length of sentences, the types of nouns, the length of words, and the number of ideas on reading difficulty. The tests were administered to thirty college students and the criterion of difficulty consisted of the rate at which the students were able to complete the readings. McClusky concluded that written material that was the least difficult to comprehend consisted of easy, familiar vocabulary and short, simple sentences. In contrast, difficult material contained technical, unfamiliar vocabulary and complex sentence structure.

An investigation was carried out by Robinson<sup>19</sup> in order to determine the effect of complexity of language structure on reading comprehension. Robinson selected four legal passages and substituted unfamiliar words with familiar words from the Thorndike list. The

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<sup>18</sup>H. Y. McClusky, "A Quantitative Analysis of the Difficulty of Reading Materials," Journal of Educational Research, XXVIII (December, 1934), 276-282.

<sup>19</sup>F. P. Robinson, "The Effect of Language Style on Reading Performance," Journal of Educational Psychology, XXXVIII (March, 1947), 149 - 156.







original sentence structure was retained in the passages. Comprehension questions were constructed to test the total meaning of the passages and the tests were administered to college students. The students obtained low comprehension scores on three of the four passages. No significant difference was found in comprehension scores between students of varied intelligence. However, a consistent trend in favour of the high intelligence group was noted. Students in law did significantly better than those who had taken no law course when the intelligence factor was controlled. Robinson concluded that aside from the vocabulary factor, the factor that accounted for the difficulty experienced by the students was language structure. He also noted that training appears to affect facility in comprehending discourse that contains a complex language style.

In a study reported by Klare, Mabry, and Gustafson,<sup>20</sup> the relation of style difficulty to immediate retention of information, rate of reading, and reader judgment of difficulty was determined. The style factors considered were average sentence length, the proportion of simple sentences, the proportion of prepositional phrases, the proportion of active to passive constructions, the percentage of short, familiar, frequently used words, and the proportion of abstract to concrete words. The investigators used the Dale-Chall

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<sup>20</sup>G. R. Klare, J. E. Mabry, and L. M. Gustafson, "The Relationship of Style Difficulty to Immediate Retention and to Acceptability of Technical Material," Journal of Educational Research, XLVI (May, 1955), 287-295.



readability formula, the Flesch Reading Ease, and the Flesch Level of Abstraction formulae and wrote Easy, Standard, and Hard versions of a technical article. They varied the levels of difficulty by controlling the factors to be studied. "Easy" style was rated at seventh to eighth grade level, "Standard" style was rated at the eleventh to twelfth grade level, and "Hard" style was rated at the sixteenth grade level and above. The subjects were Air Force personnel. A multiple-choice test and limited reading time served as the respective criteria for comprehension difficulty and rate of reading. Acceptability of material was rated on the basis of the airmen's judged difficulty. The researchers concluded that, by accounting for the factors studied, an easier "style" may result in greater immediate retention, greater reading coverage in a given time, and greater acceptability of reading material.

## II. STUDIES ON LANGUAGE PATTERNS OF CHILDREN

At the elementary level there is a growing interest in the linguistic analysis of children's language. Two of these studies have utilized Chomsky's model of a generative grammar for this purpose. There have also been some attempts to analyze the syntactic structures present in textbooks at the elementary level in order to compare the oral language of students with the language presented in textbooks. This section will consider some of these studies.







Menyuk<sup>21</sup> devised a study with the stated purpose of determining whether Chomsky's model of syntactic structures was capable of indicating developmental trends. Her sample consisted of nursery school and first grade children. The basic structures which generated all the sentences in the total language sample could be described within the framework of this model. Menyuk concluded that the technique was successful and that it gave new and insightful ways for looking at grammatical development in the language of children. No studies were found which analyzed the language of high school students using the same technique.

Loban<sup>22</sup> reported an investigation of the language of elementary students. As part of the study the transformational grammar technique was applied to the oral language of two subjects and Loban concluded that this kind of analysis is a valuable method for studying grammatical complexity. He found that the complexity of grammatical structure is associated not only with chronological age but also with proficiency in language. Although the major part of Loban's study applied a different technique than that supplied by Chomsky, he obtained some interesting results. Loban found that the group who

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<sup>21</sup>Paula Menyuk, "A Descriptive Study of the Syntactic Structures in the Language of Children: Nursery School and First Grade" (unpublished Ed. D. thesis, University School of Boston, Boston, 1961), 82 pp.

<sup>22</sup>Walter Loban, The Language of Elementary School Children (NCTE Research Report No. 1, Champaign, Illinois: National Council of Teachers of English, 1963), 92 pp.



rated high in language ability are more fluent and have a larger and more varied vocabulary than do students who are rated low. Members of the low group experienced considerable difficulty in using and controlling patterns of syntax. The low group also used more partial expressions or sentences that are incomplete than did the high group. The adverb and noun clauses are used much more frequently than the adjective clause by both groups. He also found that there is a positive relationship between spoken language and reading.

Strickland<sup>23</sup> used a linguistic analysis of elementary textbooks for the purpose of discovering which of the language patterns used most frequently by children appeared in a selected sample of reader pages. Since this investigation was only a small part of a much larger study the results were confined to certain generalizations. The basic Subject-Verb-Object pattern was the only pattern to appear in the samples of practically all the books. Other patterns that appeared differed from book to book within a series as well as from series to series. Once a pattern was introduced there appeared to be no effort made to provide repetition of the pattern. Patterns of sentence structure appeared to be introduced at random

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<sup>23</sup>Ruth G. Strickland, The Language of Elementary School Children: Its Relationship to the Language of Reading Textbooks and the Quality of Reading of Selected Children (Bulletin of the School of Education, Indiana University, XXXVIII:4, July, 1962), pp. 62-70.







and there appeared to be no scheme for the development of control over sentence structure which paralleled the generally accepted scheme for the development of control over vocabulary.

These studies of children's language and Strickland's examination of basal readers are interesting and insightful. The attempt to examine spoken and written language within a theoretical framework offers a new approach to the investigation of the sentence as a contributor to the difficulty of understanding written discourse.

### III. PSYCHOLINGUISTIC STUDIES BASED ON CHOMSKY'S MODEL

Miller<sup>24</sup> points out that investigations into linguistic behaviour frequently emphasize problems of meaning. Meaning is usually defined by psychologists in terms of reference, that is in terms of an arbitrary association between some referent and a vocal utterance. Reference is then reduced to a simple matter of conditioning. Miller contends that this is a narrow approach to the psycholinguistic problem since the important skill of arranging symbols in novel and useful ways is largely ignored. He states:

....there is much more to our linguistic skills than just referential process. I do not see how we are going to describe language as a skill unless we find some satisfactory way to deal with grammar and with the combinatorial process that language entails.<sup>25</sup>

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<sup>24</sup>G.A. Miller, "Some Psychological Studies of Grammar," American Psychologist, XVII (November, 1962), 748.

<sup>25</sup>Ibid.



Although there have been some attempts by psychologists to describe 'grammaticality' Saporta<sup>26</sup> reports that this has been done exclusively in terms of habit strength, reinforcement, generalization, frequency and so on. He suggests that these frameworks are inadequate since some of the most obvious facts of language, such as the ability of a speaker to produce or 'understand' grammatical nonsense which he has never heard before, and to distinguish it from ungrammatical nonsense, is not accounted for within these frameworks.

In order to investigate the highly complicated skill of human language, Miller suggests a different approach from what has been used in the past. He states:

....talk about hypothesis testing instead of discrimination learning, about the evaluation of hypotheses instead of the reinforcement of responses, about rules instead of habits, about productivity instead of generalization, about innate and universal human capacities instead of special methods of teaching vocal responses, about symbols instead of conditioned stimuli, about sentences instead of words or vocal noises, about linguistic structure instead of chains of responses -- in short, about language instead of learning theory.<sup>27</sup>

A number of studies of language incorporating these concepts have been carried out as a by-product of work in generative grammar. In particular these studies have indicated additivity in the time

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<sup>26</sup>Sol Saporta (ed.), Psycholinguistics: A Book of Readings (New York: Holt, Rinehart and Winston, 1961), p. v.

<sup>27</sup>George A. Miller, "Some Preliminaries to Psycholinguistics," American Psychologist, XX (January, 1965), 20.







required to perform or process complex grammatical transformations and the limitations on performance imposed by organization of memory and bounds on memory.

Miller<sup>28</sup> tested the assumption that the more complicated a grammatical transformation is, the longer it will take to perform it. In order to test this assumption Miller devised a sentence-matching test in which corresponding sets of negative, passive, and passive-negative transformations derived from eighteen kernel sentences were presented to subjects for matching within a fixed interval of time. As a control condition, other tests were presented which required no transformations -- only search. Sentences in one column were matched with the identical sentences in another column. In this way an estimate of the time required to recognize, analyze, and transform the sentence could be separated from the time spent in searching and writing. The data thus gathered on sentence-identification time, indicates that the time taken to match two sentences, differing only in their transformational history, is a function of the number of transformational rules by which their histories differ.

Gough<sup>29</sup> tested the hypothesis that the hearer of a complex sentence must transform that sentence into the underlying kernel sentence before understanding it, and hence the speed of understand-

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<sup>28</sup>G. A. Miller, "Some Psychological Studies of Grammar," American Psychologist, XVII (November, 1962), 757-759.

<sup>29</sup>Philip B. Gough, "Grammatical Transformations and Speed of Understanding," Journal of Verbal Learning and Verbal Behaviour, IV (1965), 107-111.



ing a sentence would vary with the number and nature of the transformations separating it from its kernel. Descriptive sentences of varying grammatical form were presented to subjects who were asked to verify them, and the speed of verification was taken as an index of speed of understanding. Active sentences were found to be verified faster than passive, affirmative faster than negative, and true faster than false. The true-false variable was found to interact with the affirmative-negative, indicating that the latter difference is not simply syntactical. However, Gough points out that the different sentence types vary in length and this could have influenced verification time. The sentence types also varied in frequency with which they have been encountered and verification time could be a function of frequency. However the consistency of the results with the hypothesis was noteworthy even though there is the possibility that transformational complexity was confounded with frequency and length.

Smith<sup>30</sup> tested the hypothesis that semantic and syntactic controls function interdependently during the process of sentence construction, with the developing meaning of a sentence being monitored at the same time that grammatical anomalies are avoided. His study was aimed at finding out whether the relative time involved in making passive or negative transformations (or their inverse) is

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<sup>30</sup>Frank Smith, "Reversal of Meaning as a Variable in the Transformation of Grammatical Sentences," Journal of Verbal Learning and Verbal Behaviour, IV (1965), 39-43.







independent of their effect on the meaning of the transformed sentence. Lists of sentences were altered in accordance with rules involving word changes to synonymous or opposite forms and grammatical transformations between positive and negative and between active and passive forms. Comparisons were made of the times required by twelve subjects to perform tasks involving one word change and one transformation, and of the times required by twelve subjects to perform tasks involving two word changes and one transformation. For each group of subjects two tasks resulted in a reversal of sentence meaning, and two did not. The prediction that change of sentence meaning would be reflected in longer performance times was generally supported for tasks involving passive transformations but not for negatives. It was concluded that the number of separate meaning reversals within a task was also a variable and that the absence of apparent effects in tasks involving negatives might be attributable to loss of awareness of meaning during more complex sequences of reversals.

Chomsky<sup>31</sup> states that certain sentences although grammatical may not be acceptable since grammaticality is only one of the many factors that interact to determine acceptability. The unacceptable grammatical sentence often cannot be used, for reasons, having to do, not with grammar, but rather with memory limitations and stylistic factors, which makes it psychologically unacceptable. Some

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<sup>31</sup>Noam Chomsky, Aspects of the Theory of Syntax (Cambridge, Mass.: The M. I. T. Press, 1965), p. 11.



investigations have been carried out with a view to determining the kinds of formal constructions in grammatical sentences that contribute to unacceptability.

Mehler<sup>32</sup> found that the majority of errors in the free recall of complex sentences are not errors of omission, inventions, or inter-sentence confusion. They are syntactical errors, sentences which could be derived from the correct sentence by applying one or more transformations or their inverses.

Miller<sup>33</sup> makes the observation that self-embedded constructions (constructions inserted into other constructions) although grammatical, are far more complicated psychologically than right-recursive constructions (constructions added to the right of a construction). He hypothesized that self-embedded constructions place heavier demands on the temporary capacity of any device that attempts to cope with it -- far heavier than do either left-recursive or right-recursive constructions. Since temporary memory is quite limited, a language user can experience great difficulty following grammatical rules in this type of syntactic structure.

Miller and Isard<sup>34</sup> report a study in which subjects were given

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<sup>32</sup>J. Mehler, "Some Effects of Grammatical Transformations on the Recall of English Sentences," Journal of Verbal Learning and Verbal Behaviour, 11 (1963), 346-351.

<sup>33</sup>George A. Miller, "Some Psychological Studies of Grammar," American Psychologist, XVII (November, 1962), 754-756.

<sup>34</sup>George A. Miller and Stephen Isard, "Free Recall of Self-Embedded English Sentences," Information and Control, VII (September, 1964), 292-303.







five trials to memorize 22-word sentences that varied in degree of self-embedding. Sentences with self-embedded phrase structure proved difficult to learn, which is interpreted to mean that the capacity of the language user to deal with recursive interruptions may be extremely limited.

#### SUMMARY

Readability research that has focused on factors of style of expression has treated the concept of readability as largely one of comprehensibility. Investigations in this area point to the fact that sentence composition in terms of words, length of sentences and kinds of structures is a contributor to difficulty in comprehending written material. Although sentence difficulty has been estimated in various ways the most utilized method appears to be by sentence length. In general, short sentences contribute to ease of understanding and long sentences contribute to difficulty of understanding, and this factor has been incorporated into readability formulae. Other research studies which have examined the effect of language structure on reading comprehension have also found that there are various elements of language structure that contribute to difficulty.

However, readability formulae have their limitations not only because of lack of refinement within the factors selected for examination but also because of exclusion of many factors which, if included in a formula, could improve the predictive power of the formula.



In order to counteract some of the limitations inherent in readability formulae the use of 'cloze' tests to predict readability has been attempted and found effective.

A syntactic analysis of sentences based upon a formal theory of language offers a new approach to the examination of the sentence as a factor which contributes to the difficulty of understanding written discourse. A formal theory of language has not yet been applied to textbook analysis but it has been used to gain insights into developmental aspects of spoken language and has proved a useful tool in that it gives a precise consideration of the organization of language.

Research in the field of psycholinguistics that has utilized the linguistic conception of a transformational grammar in order to formulate hypotheses about verbal behaviour has contributed some interesting findings concerning the ways in which sentences are understood.





## CHAPTER III

### DESCRIPTIVE THEORY OF LANGUAGE

In the last few decades there has been a development of a variety of descriptions of the structure of English. These developments are a result of new insights into language that have been made because of advances made in the science of linguistics. The major approaches to syntactic descriptions may be classified under two categories. The first is known as the structural-descriptive approach and is represented by the work of Fries, Hockett, Trager, Smith and others.<sup>1</sup> The second is known as the transformational-generative approach and is represented by the work of Chomsky, Lees, Postal, and others.<sup>2</sup>

#### I. THE AIM OF SCIENTIFIC LANGUAGE DESCRIPTION

Generally speaking, the aim of scientific language description is to state as accurately, exhaustively, concisely, and elegantly as

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<sup>1</sup>Charles C. Fries, The Structure of English (New York: Harcourt Brace and World, 1952), 304 pp.; Charles Hockett, A Course in Modern Linguistics (New York: The Macmillan Company, 1958), 621 pp.; and George L. Trager and Henry Lee Smith, Jr., An Outline of English Structure (Studies in Linguistics, Occasional Papers, No. 3. Reprinted, Washington, D.C., American Council of Learned Societies, 1957), 91 pp.

<sup>2</sup>Noam Chomsky, Syntactic Structures (The Hague: Mouton and Company, 1957), 118 pp.; Robert B. Lees, The Grammar of English Nominalizations (Bloomington, Indiana: Research Center in Anthropology, Folklore, and Linguistics, 1960), 205 pp.; and P. M. Postal, "Underlying and Superficial Linguistic Structure," Harvard Educational Review, XXXIV (Spring, 1964), 246-66.



possible the facts concerning a particular language. Rosenbaum<sup>3</sup> points out that the most readily accessible body of facts about language is the information which is available to any speaker concerning his native language. He states:

A speaker can understand sentences which he has never heard before. Similarly, he can produce new sentences on the appropriate occasion. Second, a speaker knows implicitly that certain sentences in his language are ambiguous while others are not. Still other sentences are synonymous. Third, he is capable of detecting differences in the relations which words have to one another in sentences even though these relations are not explicitly specified in the phonetic representations of sentences.<sup>4</sup>

There is general consensus in the literature about the various linguistic abilities possessed by native speakers of a language. Gleason concurs with Rosenbaum and illustrates the fact that fluent speakers of a language recognize the relationship between certain pairs of sentences of different structure since all would, without hesitation, match the following sentences in exactly the same way.

Where are you going?	That is a book.
What is that?	I like that one.
Which do you like?	I am going tomorrow.
Are you going tomorrow?	I am going home.

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<sup>3</sup>Peter S. Rosenbaum, "On the Role of Linguistics in the Teaching of English," Harvard Educational Review, XXXV (Summer, 1965), 338.

<sup>4</sup>Ibid.

<sup>5</sup>H. A. Gleason, Linguistics and English Grammar (New York: Holt Rinehart and Winston, Inc., 1965), p. 56.







When Chomsky<sup>6</sup> considers the linguistic abilities of speakers of a language he draws a distinction between a speaker's performance of his language and his competence in it. When he uses the term 'competence' which he sometimes calls 'intuition,' he means a number of things, among them that a native speaker of a language knows how to distinguish between well-formed and ill-formed sentences, that is, between grammatical and ungrammatical sentences, is aware that certain sentences are ambiguous, considers certain sentence types, for example, active/passive sentences, to be related. Performance is the speaker's implementation of his competence, and it is the performance of the speaker that is directly observable.

However, the sentences that a speaker produces can be influenced by a number of factors, many of them not connected with linguistics at all, for example, tiredness, anger, embarrassment and so on. Chomsky makes the point that "knowledge of one's language is not reflected directly in linguistic habits and dispositions."<sup>7</sup> Even though these abilities are not to be found as such in actual linguistic utterances, the central task of linguistic description is to account for these abilities. These considerations lead Chomsky to make the following comment:

Linguistic theory is concerned primarily with an ideal listener, in a completely homogeneous speech-community,

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<sup>6</sup>Noam Chomsky, "Current Issues in Linguistic Theory," The Structure of Language: Readings in the Philosophy of Language (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1964) pp. 66-67; and Noam Chomsky, Aspects of the Theory of Syntax (Cambridge, Mass.: The M.I.T. Press, 1965), pp. 4-5.

<sup>7</sup>Noam Chomsky, "Current Issues in Linguistic Theory," The Structure of Language: Readings in the Philosophy of Language (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1964), p. 52.





who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, and errors (random or characteristic) in applying his knowledge of the language in actual performance. This seems to me to have been the position of the founders of modern general linguistics, and no cogent reason for modifying it has been offered. To study actual linguistic performance, we must consider the interaction of a variety of factors, of which the underlying competence of the speaker-hearer is only one ....

The problem for the linguist, as well as for the child learning the language, is to determine from the data of performance the underlying system of rules that has been mastered by the speaker-hearer and that he puts to use in actual performance.<sup>8</sup>

A grammatical theory then must not only specify the well-formed sentences of a language, but it must also provide a structural description that will account for the facts and the special relations that exist between special pairs of sentences. Rosenbaum<sup>9</sup> criticizes the structural grammars on the grounds that the description presented is a taxonomic classification which arranges the data but makes no claim about the nature of the data. Chomsky<sup>10</sup> charges that traditional grammars are deficient in that they leave unexpressed many of the basic regularities of the language. However transformational grammar resembles traditional grammar in giving primary attention to the study

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<sup>8</sup>Noam Chomsky, Aspects of the Theory of Syntax (Cambridge, Mass.: The M.I.T. Press, 1965), pp. 3-4.

<sup>9</sup>Rosenbaum, op. cit., p. 338.

<sup>10</sup>Noam Chomsky, Aspects of the Theory of Syntax (Cambridge, Mass.: The M.I.T. Press, 1965), p. 5.





of speaker competence. It departs from traditional grammar in the explicitness of the account it provides of speaker competence. Recent work on the transformational version of generative linguistics represents the first modern attempt to develop a linguistic theory and a descriptive apparatus which have as a goal the explanation of the speaker's knowledge. The classic formulation of this theory was presented by Noam Chomsky in Syntactic Structures<sup>11</sup> which appeared in 1957. Since the appearance of the work other linguists as well as Chomsky have made modifications and substantial contributions to the original theory.

### III. CHOMSKY'S MODEL OF A TRANSFORMATIONAL-GENERATIVE GRAMMAR

Chomsky calls his grammar a transformational-generative grammar. The theory he has formulated is based on certain assumptions about the various processes that are present in language and the relationships that exist among them. In particular he makes the assumption that there are certain processes or operations, which he calls transformations, that will produce complex sentences from the structured strings which underlie simple sentences. A transformational grammar has the power not only to generate such sentences but to show how these sentences are related.

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<sup>11</sup>Noam Chomsky, Syntactic Structures (The Hague: Mouton and Company, 1957), 118 pp.



The statements of a transformational-generative grammar take the form of a set of automatically-operating, hence explicit, rules. Since the most striking manifestation of the speaker's competence is his ability to produce (and understand) many novel utterances, it is clear that any set of rules matching the speaker's competence must also have this property - must in other words, be generative.

Sentences are said to be generated in the sense that the rules show how all the sentences are constructed from underlying and often very abstract components. The components and mode of assembly then serve to specify for each generated sentence its structural analysis. A transformation grammar does not analyze arbitrarily given sentences. The sentences generated by the rules are given an analysis automatically, that is, as the grammar generates a sentence it assigns an analysis to the sentence.

A generative grammar as proposed by Chomsky in Syntactic Structures consists of a tripartite arrangement of linguistic levels; a phrase structure level which contains rules that will produce kernel or basic sentences, a transformational level which contains rules that produce more complex sentences, and a morphophonemic level which contains rules that will convert strings of morphemes into strings of phonemes.<sup>12</sup>

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<sup>12</sup>Ibid., pp. 45-46.





In his more recent work Chomsky presents a somewhat different arrangement for his grammar. The model now consists of three major components; the syntactic, the phonological and the semantic.<sup>13</sup> A system of rules operates within these components to generate an indefinite number of structures. The rules within the syntactic component generate sequences of symbols that represent the syntactic structure of sentences. The rules within the phonological component assign a pronunciation to the sequences provided by the syntactic component. The semantic component relates a structure generated by the syntactic component to a certain semantic representation. Both the phonological and semantic components are therefore interpretative since both utilize information provided by the syntactic component.<sup>14</sup> Chomsky points out that the syntactic component therefore must specify two kinds of structures; a deep structure which determines the semantic interpretation of the sentence and a surface structure which determines the phonetic interpretation of the sentence.<sup>15</sup>

#### The syntactic component

The syntactic component consists of a base subcomponent and a transformational subcomponent. The rules of the base generate the deep

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<sup>13</sup>Noam Chomsky, Aspects of the Theory of Syntax (Cambridge, Mass.: The M.I.T. Press, 1965), pp. 15-16.

<sup>14</sup>Ibid., p. 16.

<sup>15</sup>Ibid.



structure of the sentence and the rules of transformation operate on the deep structure to produce the surface component.

The base subcomponent. The rules of the base are divided into two elements, one containing phrase structure rules and the other containing a lexicon or dictionary of highly structured morpheme entries which are inserted into the structures enumerated by the phrase structure rules. These latter rules supplement the phrase structure rules by specifying the pronunciation and grammatical classification of every item in the lexicon. Grammatical classification plays an important part in co-occurrence and these rules help account for so-called 'selectional restrictions' such as the fact that certain verbs occur only with animate 'subjects' and inanimate 'objects' etc.

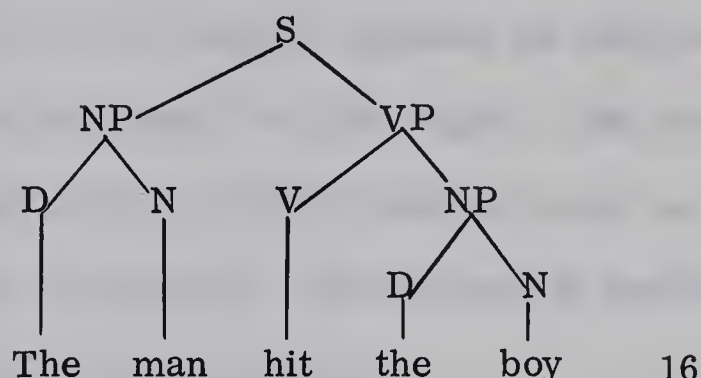
The phrase-structure rules in their simplest form correspond to two techniques of linguistic analysis that have been employed for some time. One is parsing, that is the assigning of grammatical labels such as noun, verb, to parts of a sentence. The other is immediate constituent analysis which attempts to break down constructions into subparts that are in some sense grammatically related. For example, in the sentence the man hit the ball, the man seems to be more closely related than man hit. Traditional grammar presents this kind of information about a sentence. However, Chomsky is concerned with how information of this kind can be presented in a structural description and how such a description can be generated by a system of explicit







rules. He illustrates how this information can be represented formally by a branching tree-diagram, which he calls a phrase-marker.



Specific notations are given for the various kinds of constituent units. The is a determiner and is symbolized by the notation D; man is a noun and is symbolized by the notation N. Together they form the noun phrase which is symbolized by the notation NP. The verb hits is symbolized by the notation V and combines with the following noun phrase the ball (D + N) to form the verb phrase which is symbolized by the notation VP. Thus a sentence is composed of a linear concatenated sequence of immediate constituents. The point at which each of these symbols occurs in the tree is called a node. The 'S node' is said to dominate the 'NP node and the VP node'. The lines connecting the nodes are called branches.

In a generative grammar a system of rewrite rules of the form  $A \rightarrow Z/X - Y$  is used to generate a phrase-marker. This rule supplies the operation whereby a change is effected in a symbolization in order

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<sup>16</sup>Noam Chomsky, Syntactic Structures (The Hague: Mouton and Company, 1957), p. 27.



to make it more explicit and specific. 'A' is a single category symbol (S, NP, V, etc.), 'Z' is a string of symbols that are the immediate constituents of 'A' when it appears in the environment consisting of X to the left and Y to the right. The arrow means "rewrite as." The application of this rewrite rule to a string XAY will convert it to the string XZY. The following rewrite rules will produce the phrase-marker shown earlier.

#S#

- |         |      |   |                 |
|---------|------|---|-----------------|
| Rule 1. | S    | → | NP + VP         |
| Rule 2. | NP   | → | D + N           |
| Rule 3. | VP   | → | Verb + NP       |
| Rule 4. | D    | → | the             |
| Rule 5. | N    | → | man, ball, etc. |
| Rule 6. | Verb | → | hit, took, etc. |

Each expression in the rules constitutes a single symbol called a marker. Thus VP is a marker. With respect to a given set of rules every marker that can be rewritten is called a nonterminal marker. With respect to a given set of rules every marker that cannot be rewritten is called a terminal marker. Thus 'man' cannot be rewritten and is called a terminal marker. Any linear sequence of terminal markers resulting from the rules is called a terminal string. The process of producing a sentence with this grammar is called a derivation. A derivation of a terminal string is constructed by successively applying the rewriting rules of the grammar one at a time beginning with the initial string #S# until the final string of the





derivation consists only of formatives (man, boy) and therefore no further rewriting is possible.

This presentation of the phrase structure rules is vastly simplified. The grammar must be considerably enlarged in order to give a more realistic presentation of English. For example, the verb system in English is a complex structure and this complexity is not fully accounted for in the symbol VP. However the fundamental principals that underlie the grammar presented will not change.

In his recent work Chomsky enlarges the concept of the phrase-structure grammar by deleting the rules that introduce the formatives belonging to lexical categories.<sup>17</sup> These are rules 4, 5, and 6 relating to the formatives the, man, ball, hit, and took. At this point rewrite rules are introduced that apply to symbols for lexical categories such as N, V etc. These rules introduce or operate on complex symbols (sets of specified syntactic features). Each lexical formative such as boy, hit, will have associated with it syntactic features such as are shown below.

Rule 1.	N	→	[+N, +Common]	
Rule 2.	[+Common]	→	[+Count]	
Rule 3.	[+Count]	→	[+Animate]	
Rule 4.	[-Common]	→	[+Animate]	
Rule 5.	[+Animate]	→	[+Human]	
Rule 6.	[-Count]	→	[+Abstract]	18

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<sup>17</sup>Noam Chomsky, Aspects of the Theory of Syntax (Cambridge, Mass.: The M.I.T. Press, 1965), pp. 82-86.

<sup>18</sup>Ibid., p. 85.



Instead of the rules to introduce the formatives the grammar now contains a lexicon which is simply a list of all lexical formatives and a collection of syntactic features. The following is an example of an entry.

(boy, [ +N, -Count, +Common, +Animate, +Human ] )<sup>19</sup>

The application of these rules will produce a lexical terminal string. By applying to the lexical terminal string the morphophonemic rules required and substituting for each remaining item its phonemic representation a kernel sentence is generated.

The transformational subcomponent. To specify how the basic design which has been presented is modified and expanded to generate longer and/or more complex sentences, new rules are needed, among them transformations. In its operation a transformation may perform one or more of the following functions. The examples to illustrate these functions are presented by Goodman.<sup>20</sup>

a. It may rearrange elements in a string.

Example: String: NP + V + Adv = The man walked slowly.  
 Transform: NP + Adv + Verb = The man slowly walked.  
 (Adv and Verb are rearranged.)

b. It may add elements to a string.

Example: String: NP<sub>1</sub> + V + NP<sub>2</sub> = The man hit the ball.  
 Transform: NP<sub>2</sub> + be + V + by + NP<sub>1</sub> = The ball was hit by the man.  
 (be and by are added; also the NP's are rearranged.)

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<sup>19</sup>Ibid.

<sup>20</sup>Ralph Goodman, "Transformational Grammar," An Introductory English Grammar (New York: Holt, Rinehart and Winston, 1965), pp. 348-349.







c. It may delete elements.

Example: String: You + will + V = You will go.  
 Transform: V = Go.  
 (you and will are deleted.)

d. It may "combine" two or more strings.

Example: String: 1.  $NP_1 + V_1 = \text{John walks.}$   
 2.  $NP_1 + V_2 = \text{John giggles.}$   
 Transform:  $NP_1 + \text{who} + V_2 + V_1 = \text{John, who giggles, walks.}$   
 (Strings 1 and 2 are combined;  $NP_1$  of string 2 is deleted; who is added to replace  $NP_1$  of string 2.)

Example: String: 1.  $NP + V = \text{John knows.}$   
 2.  $S = \text{The world is round.}$   
 Transform:  $NP + V + \text{that} + S = \text{John knows that the world is round.}$   
 (Strings 1 and 2 are combined; that is added.)

These examples illustrate the fact that the infinite number of possible sentences in English are all either kernel sentences or in effect one or more of the following. (1) rearrangements of kernel sentences, (2) additions to kernel sentences, (3) deletions from kernel sentences and/or combinations of kernel sentences. It should be understood that nonkernel sentences do not really result from a combination or modification of kernels but strictly speaking result from a combination or modification of grammatical structures that underlie kernels.

Transformation rules can be obligatory or optional. Certain rearrangement of elements in a sentence are obligatory and the transformational rule must be applied in order to obtain a grammatical sentence. The following is an example of an obligatory transformation.



Tob:  $Af + v \longrightarrow v + Af$

The symbol Tob states that the rule is a transformational rule and that it is obligatory. The double arrows identify the rule as being a transformational rule. Af is the symbol for affix and v is the symbol for verb. The rule states that whenever an affix followed by a verb occurs in a derivational string the order of the affix and the verb are to be reversed so that the affix becomes attached to its proper place at the end of the verb.

The PS grammar can be further expanded to accept elements which will allow certain other operations to occur. The passive transformation, which is an optional transformation, is an example. The element Tpas, which represents the passive transformation is added to NP<sub>2</sub> in the rules. It is enclosed in parenthesis which means that it is optional. If selected, the passive transformation must be applied. The formula for the passive transformation is as follows.

$$NP_1 + Verb - Tpas + [past] + NP_2 \xrightarrow{Tpas} \begin{matrix} NP_2 + be + [past] + Verb \\ Tpas + pp (+by + NP_1) \end{matrix} \quad ^{21}$$

The element past in brackets is optional. However if it is selected in the string on the left it must also be selected in the string on the right. The pp stands for the past participle morpheme. The elements included in the parentheses mean that the selection of

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<sup>21</sup>Goodman, op. cit., p. 351.







these elements is optional. The Tpas at the end of the string on the left means that the passive transformation is to be applied.

Other transformational rules will distort the basic order of elements so that the interrogative and imperative forms of sentences will be generated. The applications of appropriate transformational rules to the strings that underlie two or more kernel sentences will conjoin or embed these sentences to produce the more complex sentences of the language. These transformations will require the inclusion of the optional marker S (sentence) in the phrase structure rules after each NP. The S marker can be rewritten as NP + VP. This in turn allows for the inclusion or addition of more than one terminal string and will give a combination of two or more kernel sentences.

### The phonological component

The set of rules within the phonological component of a transformational grammar specify the phonetic character of each structure that is generated by the rules within the syntactic component. These rules are applied to the final derived phrase markers and associate a phonetic representation with each. Postal<sup>22</sup> notes that these rules must also characterize the notion of 'phonetically possible morpheme'. That is, these rules will state that in English that although neither ftorts or geyk is an actual morpheme, the latter but not the former is a possible morpheme.

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<sup>22</sup>Postal, op. cit., p. 258.



### The semantic component

A full linguistic description must specify how semantic interpretations are assigned to the structures generated by the syntactic rules, since it is evident that speakers know the meanings of sentences as well as grammatical structure and pronunciation features. On-going work in transformational grammar is presenting some new insights into the problem but considerable work still remains to be done in this area.

### SUMMARY

In this chapter the aims of scientific grammar have been discussed in order to provide a rationale for the treatment accorded to a descriptive grammar by Chomsky. In the grammar Chomsky presents it appears that the linguistic knowledge whose possession characterizes a speaker of a language has the form of an abstract linguistic object containing three major components of rules.

The basic element is a generative syntactic component whose rules generate highly complex structures. Then there are two subsidiary interpretive components. The phonological component provides each sentence with a phonetic interpretation and accounts for the speaker's knowledge of the facts of pronunciation. The semantic component provides each sentence with a semantic interpretation and accounts for the speaker's knowledge of the facts of meaning.







## CHAPTER IV

### DESIGN OF THE STUDY

This chapter describes 1) the textbook sample selected for investigation, 2) the procedure that was followed in obtaining passages for examination, 3) a detailed explanation of the method employed to describe the syntactic structures pertinent to the study, and 4) the treatment of the data.

#### I. THE TEXTBOOK SAMPLE

The textbooks examined were social studies texts used in grades ten, eleven, and twelve in the province of Alberta. The Senior High School Curriculum Guide for Social Studies 10, 20, and 30<sup>1</sup> lists primary texts for each grade level and a considerable number of secondary texts. Students are expected to make extensive use of the secondary texts as well as the primary texts. From these authorized texts a primary text for each grade along with one secondary text for each grade was selected for examination. The following are the texts that were used.

##### Primary texts

Grade X Hardy, W.G. Our Heritage from the Past. Toronto: McClelland and Stewart Limited, 1964. 244 pp.

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<sup>1</sup>Department of Education, Senior High School Curriculum Guide for Social Studies 10, 20, and 30, (Edmonton, Alberta, 1965).



- Grade XI Adams, Fay., et al. The Story of Nations. Toronto: Clarke, Irwin & Company Limited, 1953. 626 pp.
- Grade XII Lawrence, Bertha., et al. Canada in the Modern World. Toronto: J.M. Dent & Sons (Canada) Limited, 1955. 468 pp.

### Secondary texts

- Grade X Davis, William Stearns, A Day in Old Rome: A Picture of Roman Life. New York: Biblo and Tannen, 1963. 482 pp.
- Grade XI Brown, George W. Building the Canadian Nation. Toronto: J.M. Dent & Sons (Canada) Limited, 1958. 658 pp.
- Grade XII Rowat, Donald C. Your Local Government: A Sketch of the Municipal System in Canada. Toronto: The Macmillan Company of Canada Limited, 1955. 158 pp.

## II. PROCEDURE FOR OBTAINING PASSAGES FOR EXAMINATION

Each text was examined in the following manner. Beginning with the first page approximately one hundred word samples were selected from every tenth page. A sample was never begun or ended in the middle of a sentence. A sentence was assumed to extend from a capital which appeared after a period, a question mark, or an exclamation mark to a period, a question mark, or an exclamation mark which immediately preceded a capital letter. All the sentences in the sample were counted. A separate count was taken of every sentence that contained one or more noun modifiers. The frequency of occurrence of each modifier was also recorded. Chapter title, paragraph headings, captions for graphs, charts, maps, and pictures were omitted.







### III. METHOD OF ANALYSIS

The following structures were selected for a syntactical description; relative clauses, prenominal adjectives, participles, participial phrases, infinitive phrases, prepositional phrases, phrases with an initial adjective, appositive noun phrases, appositive adjectives, and adverbs of place.

Smith<sup>2</sup> using Chomsky's generative grammar as a frame of reference observed that all of the noun modifiers listed above could be accounted for by three transformational rules. The application of one rule will produce the relative clause and the application of two and three rules will produce the remaining modifiers. The relative clause transformation acts on two source sentences that share a same noun phrase and permits the embedding of one sentence into another sentence. The application of the deletion transformation reduces the relative clause by the deletion of *wh-is*. The remaining elements may be called relative clause reductions. The names for these structures that are described as reductions of the relative clause are: prenominal adjectives, participles, participial phrases, infinitive phrases, prepositional phrases, phrases with an initial adjective, appositive noun phrases, appositive adjectives, and adverbs of place. When these

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<sup>2</sup>Carlota S. Smith, "Determiners and Relative Clauses in a Generative Grammar of English," Language, XI:1 (January-March, 1964), 37-52.



reductions consist of more than a single term they remain in post-nominal position. Relative clause reductions of a single term must move to the prenominal position. The third rule, the order change transformation, provides for this shifting and the resultant pre-nominal modifiers are named participles and adjectives.

The particular format of each of the transformational rules used in this study has been designed by Roberts.<sup>3</sup>

The symbol SD stands for the term 'structural description', the symbol SC stands for the term 'structural change', and the symbol Se stands for the term 'sentence'. Figure 1 is a formal statement of the rule for the relative clause transformation and Figure 2 illustrates an application of the rule.

#### RELATIVE CLAUSE TRANSFORMATION

T - rel:	Insert	X	-	NP <sub>1</sub>	-	Y
	SD	1		2		3
	Matrix	Z	-	NP <sub>1</sub>	-	W
		4		5		6
				who		
SC	Z + NP <sub>1</sub>	+		which	+	X + Y + W
				that		
	4 5				1	3 6

FIGURE 1

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<sup>3</sup>Paul Roberts, English Syntax (New York: Harcourt, Brace and World, 1964), pp. 400-401.









which is used when the NP refers to anything other than a person; that may be used with all NP's. If the NP in the insert string is an object, it must be accompanied by the morpheme m which will convert the pronoun who into whom. If the NP is a possessive it will be accompanied by the symbol Pos which will convert the relative pronoun into whose. When the relative pronoun in the clause is preceded immediately by a preposition, a special rule is required to generate the clause. Figure 3 states the appropriate rule necessary to produce the clause when this particular condition is present.

Se1 The man is here.  
Se2 I spoke to the man.

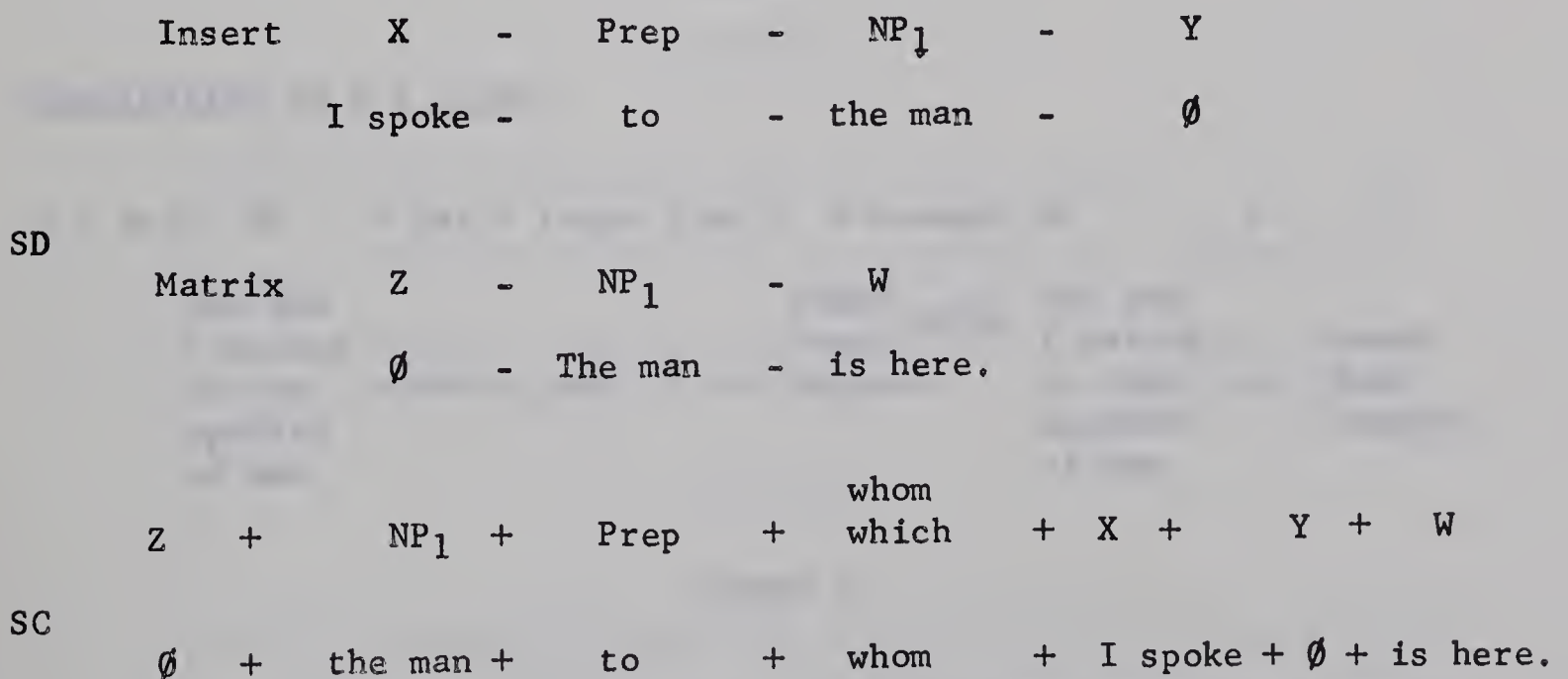


FIGURE 3





When the relative clause contains the sequence NP + relative pronoun + tense + be + X, the second rule, the deletion transformation, may be applied. The application of the second transformation will produce participial phrases, infinitive phrases, prepositional phrases, phrases with an initial adjective, appositive noun phrases, appositive adjectives, adverbs of place and single participles and adjectives in the postnominal position. Figure 4 illustrates the rule necessary to produce the above mentioned structures and Figure 5 illustrates an application of the deletion transformation.

#### DELETION TRANSFORMATION

T - del: NP + rel + tense + be + X  $\Rightarrow$  NP + X

FIGURE 4

#### Application of a T - del

T - del: NP		+	rel	+	tense	+	be	+	X	$\Rightarrow$	NP	+	X
You and											You and		
I belong											I belong		named
to the	+	who	+	pres	+	is	+	Sapiens			to the	+	Homo
species											species		Sapiens
of man											of man		

FIGURE 5

When the application of this transformation produces a single word modifier (in the X position) the third rule, the order change



transformation, is obligatory, that is, it must be applied. The order change transformation may be called the TNM transformation. This transformation shifts a noun modifier from the position after the noun to the position before the noun. Figure 6 is a statement of the rule and Figure 7 illustrates an application of the rule.

#### ORDER CHANGE TRANSFORMATION

T - NM: D + N + adj  $\Rightarrow$  D + adj + N

FIGURE 6

#### Application of a T - NM

T - NM: D + N + adj  $\Rightarrow$  D + adj + N  
 the + men + weary  $\Rightarrow$  the + weary + men

FIGURE 7

Smith<sup>4</sup> lists these three operations as follows:

A. Relative clause    B. Postnominal    C. Prenominal

Operation:	Subjoin sentence with wh-	Delete wh-is	order change NA $\Rightarrow$ AN
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FIGURE 8

The three operations that have been described in this section

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<sup>4</sup>Carlota S. Smith, "A Class of Complex Modifiers in English," Language, XXXVII:3 (1961), 346.





give an explicit description of the modification structures selected in the textbooks. A description given in terms of a transformational grammar illustrates that these structures have not only a functional relationship (modification) but are also related syntactically.

Grammatical complexity can be determined by the number of rules required to produce a structure. A structure that is produced by three rules, such as the prenominal participle, is considered a more complex structure than the relative clause which is produced from only one rule.

The transformational description presents a methodology that consistently yields the same results. Two analysts examining the same sample and using the procedures outlined must arrive at the same results.

#### IV. TREATMENT OF THE DATA

All data gathered from the six texts were recorded on large work sheets. From the data gathered were derived the frequency of occurrence of modification structures generally and specifically in each text. The frequency of occurrence of each structure is presented in terms of raw scores and the frequency of occurrence of sentences that contained the structures is given in terms of percentages. Tables and figures were designed to indicate information about each text separately and to show comparisons between two texts at the same grade level and among texts at different grade levels.



The texts are identified according to grade level and as primary or secondary references as designated in the Senior High Curriculum Guide for Social Studies 10, 20, and 30.<sup>5</sup> The text Our Heritage from the Past is a grade ten primary text and is designated as X - P. The text Your Local Government is a grade twelve secondary text and is designated as X11 - S.

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<sup>5</sup>Department of Education, Senior High School Curriculum Guide for Social Studies 10, 20, and 30 (Edmonton, Alberta, 1965).





## CHAPTER V

### ANALYSIS OF DATA

This chapter contains data that was provided by an examination of social studies texts at the high school level.

Prior to the examination, separate sheets were allotted for each text and columns were designated to contain the following information:

- (1) page number of each sample, (2) number of sentences examined,
- (3) number of sentences that contained relative clauses, (5) number of prenominal adjectives and number of sentences that contained prenominal adjectives, (6) number of participles and number of sentences that contained participles, (7) number of participial phrases and number of sentences that contained participial phrases, (8) number of infinitive phrases and number of sentences that contained infinitive phrases,
- (9) number of prepositional phrases and number of sentences that contained prepositional phrases, (10) number of phrases with an initial adjective and number of sentences that contained phrases with an initial adjective, (11) number of appositive noun phrases and number of sentences that contained appositive noun phrases, (12) number of appositive adjectives and number of sentences that contained appositive adjectives, and (13) number of adverbs of place and number of sentences that contained adverbs of place.

All of the above structures were defined in terms of Chomsky's grammar as outlined in Chapter IV. This grammar provided for an



explicit description of each of the above modifying units and also indicated the syntactical relationship that exists among them. This relationship is clearly indicated since the application of the T-relative transformation will produce the relative clause; the application of the T-relative transformation and the T-deletion transformation will produce the participial phrase, the infinitive phrase, the prepositional phrase, the appositive adjective, the phrase with an initial adjective, the appositive noun phrase, and the adverb of place; the application of the above two rules and the order change transformation will produce the prenominal adjective and the prenominal participle.

Grammatical complexity was determined by the number of rules required to produce a structure from two or more source sentences. A structure that was produced by three rules, such as the prenominal participle was considered a more complex structure than the relative clause which was produced by the application of only one rule.

From the data gathered from the texts were derived the frequency of occurrence of modification generally and specifically in the selected samples. The frequency of occurrence of each structure is given in terms of raw scores and the frequency of occurrence of sentences that contained the structures is given in terms of percentages. The tables and figures included in the chapter record information about each text separately and show comparisons between two texts at each grade level and among texts at different grade levels.







# I. TOTAL RAW SCORES: FREQUENCY DATA ON TEXTBOOK SAMPLES

Beginning with the first page of each text approximately one hundred word samples were selected from every tenth page. All the sentences in the sample were counted and a separate count was taken of every sentence that contained one or more noun modifiers. The total raw scores for each text for the number of samples, the number of sentences, and the number of sentences that contained noun modifiers are presented in Table 1.

TABLE 1

SUMMARY OF NUMBERS OF SAMPLES AND SENTENCES EXAMINED AND SENTENCES EXTRACTED CONTAINING SELECTED NOUN MODIFIERS

	Text 10-P	Text 10-S	Text 11-P	Text 11-S	Text 12-P	Text 12-S
Number of samples	24	48	59	64	46	14
Number of sentences	147	208	321	294	197	69
Number of sentences containing modifiers	105	180	242	258	164	59

The total number of samples examined for each text varied from fourteen to sixty-four. This variation is accounted for by the fact that the texts differed in length. Although there was a considerable variance in the number of sentences examined in each text, well over half of the sentences examined in each text contained noun modifiers.



Table II provides a breakdown of the accumulated data to show the frequency of occurrence of selected modifiers for each text at all levels. The total raw scores for the following syntactic units that were present in the representative samples are given: (1) relative clauses, (2) prenominal adjectives, (3) participles, (4) participial phrases, (5) infinitive phrases, (6) prepositional phrases, (7) phrases with an initial adjective, (8) appositive noun phrases, (9) appositive adjectives, and (10) adverbs of place.

TABLE II

SUMMARY OF FREQUENCY OF OCCURRENCE OF SELECTED  
NOUN MODIFIERS FOR EACH TEXT

Structure	Text 10-P	Text 10-S	Text 11-P	Text 11-S	Text 12-P	Text 12-S
Relative clause	18	40	555	57	40	15
Prenominal adjective	111	315	332	417	300	96
Participle	7	28	16	16	16	8
Participial phrase	13	39	18	28	33	9
Infinitive phrase	3	4	2	5	2	0
Prepositional phrase	10	15	32	57	40	17
Phrases with initial adjective	1	20	7	18	6	3
Appositive adjective	0	0	6	18	0	0
Appositive noun phrase	18	15	14	18	5	1
Adverb of place	0	0	0	0	1	0





The structure that appeared most often in all texts was the prenominal adjective. This structure appeared from five to seven times as often as any other structure. The relative clause construction had the next highest rate of occurrence in the grade ten and eleven texts. However in the grade eleven secondary text the prepositional phrase was also found to occur as often as the relative clause. The pattern of equal occurrence of the relative clause and the prepositional phrase was also found in the grade twelve primary text. The grade twelve secondary text contained more prepositional phrases than relative clauses. In the grade ten primary text the appositive phrases appeared as often as did the relative clause. The participial phrase had the next highest rate of occurrence in all texts. These phrases appeared more often than did the single term participle. Although the appositive noun phrase appeared to some extent in the grade ten and eleven texts, there was a reduction of the appearance of this structure in the grade twelve texts. Phrases with an initial adjective had a fairly high frequency in the grade ten and eleven secondary texts. The appositive adjective appeared only in the grade eleven texts and the adverb of place appeared in only one sample in the grade twelve primary text.

It is interesting to note that the structure that occurred most often, the prenominal adjective, is the most deeply embedded of all structures. The common use of a deeply embedded construction raises the question of whether understanding of written discourse



might be facilitated if this structure was presented as a relative clause which is a less complex structure. However it is possible that the factor of redundancy compensates for grammatical complexity.

The relative clause which is the least deeply embedded of all structures had a high rate of occurrence as did the prepositional phrase which is a more deeply embedded structure. Readability formulae have included both the relative clause and the prepositional phrase as predictors of difficulty. The first is a longer structure than the second, and the second is a more deeply embedded structure than the first. The question arises as to which is the more difficult to understand in written discourse.

## II. PERCENTAGE SCORES: FREQUENCY DATA ON INDIVIDUAL TEXTS

The frequency of occurrence of sentences that contained each type of modifier in all texts is presented in percentage form. The tabulation for each text is given in Figures 9 to 14.

### Text 10-P: Our Ancient Heritage

The amount of noun modification found to be present in the samples examined in this text was 71.43 per cent. Figure 9 presents percentage of occurrence of selected structures in text 10-P. Eight of the ten modification structures sought were found in the sample sentences. Although a wide variety of structures was found, the occurrence of these units ranged from heavy use to occasional use. The prenominal adjective was the modification structure that was the







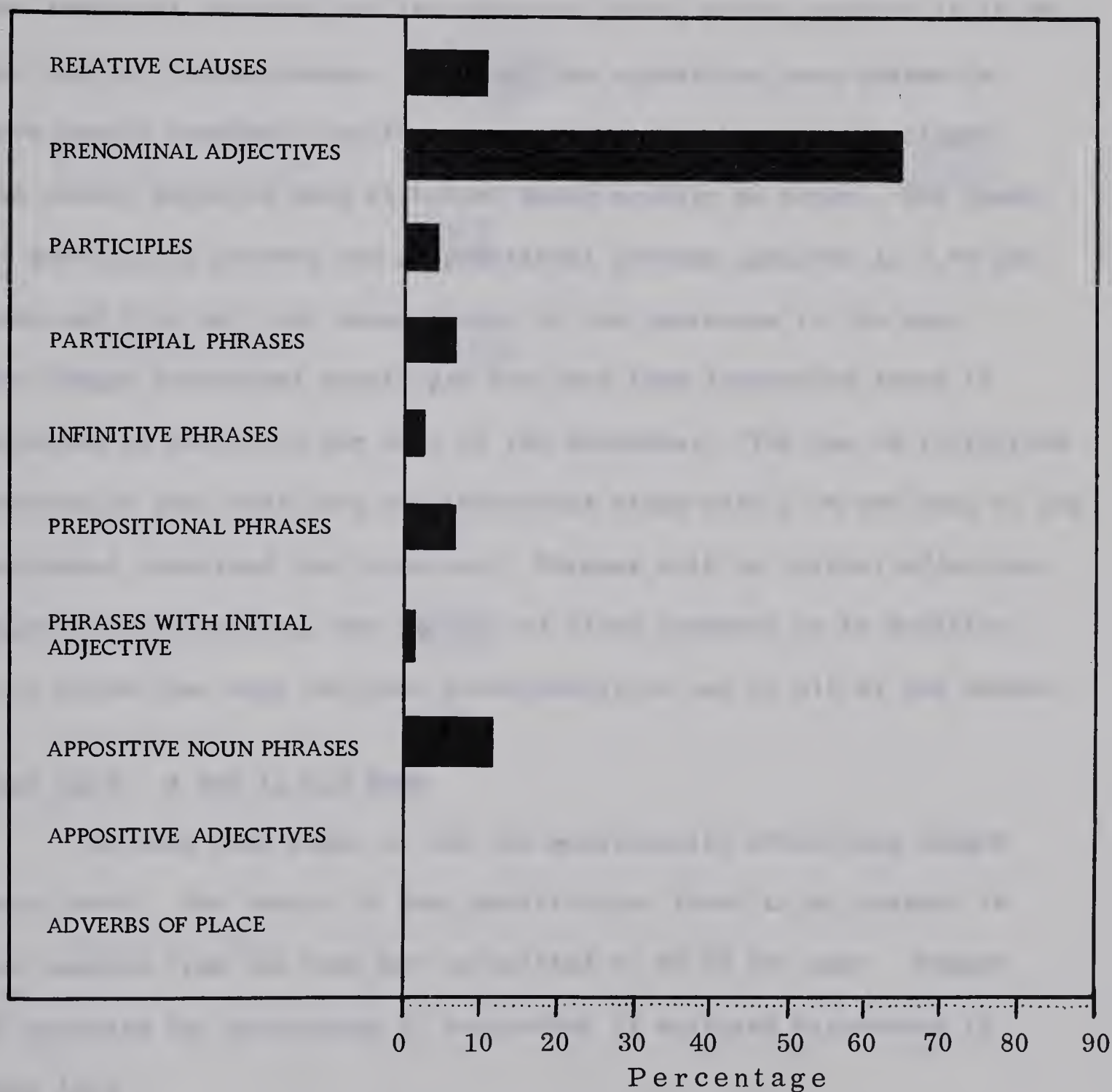


FIGURE 9

PERCENTAGE OF OCCURRENCE OF SELECTED STRUCTURES IN TEXT 10-P



Figure 1: Percentage of respondents for various categories.

most frequently employed by the author. This unit appeared in 64.64 per cent of the sentences examined. The most commonly used structures were the appositive noun phrase which occurred in 11.56 per cent of the sentences examined and the relative clause which appeared in 10.88 per cent of the sentences. Although the appositive noun phrase is more deeply embedded into the sentence than is the relative clause the author employed each structure about equally as often. The number of participial phrases and prepositional phrases appeared in 7.48 per cent and 6.12 per cent respectively in the sentences in the text. The single prenominal participle was used less frequently since it occurred in only 4.76 per cent of the sentences. The use of infinitive phrases as noun modifiers was infrequent since only 2.04 per cent of the sentences contained the structure. Phrases with an initial adjective, appositive adjectives, and adverbs of place appeared to be modification units that were employed infrequently or not at all by the author.

Text 10-S: A Day in Old Rome

In this text eight of the ten modification structures sought were found. The amount of noun modification found to be present in the samples from the text was calculated at 86.53 per cent. Figure 10 presents the percentage of occurrence of selected structures in text 10-S.

The prenominal adjective had the highest rate of occurrence of all structures since it appeared in 76.92 per cent of the sentences. The relative clause construction was utilized in 17.78 per cent of the





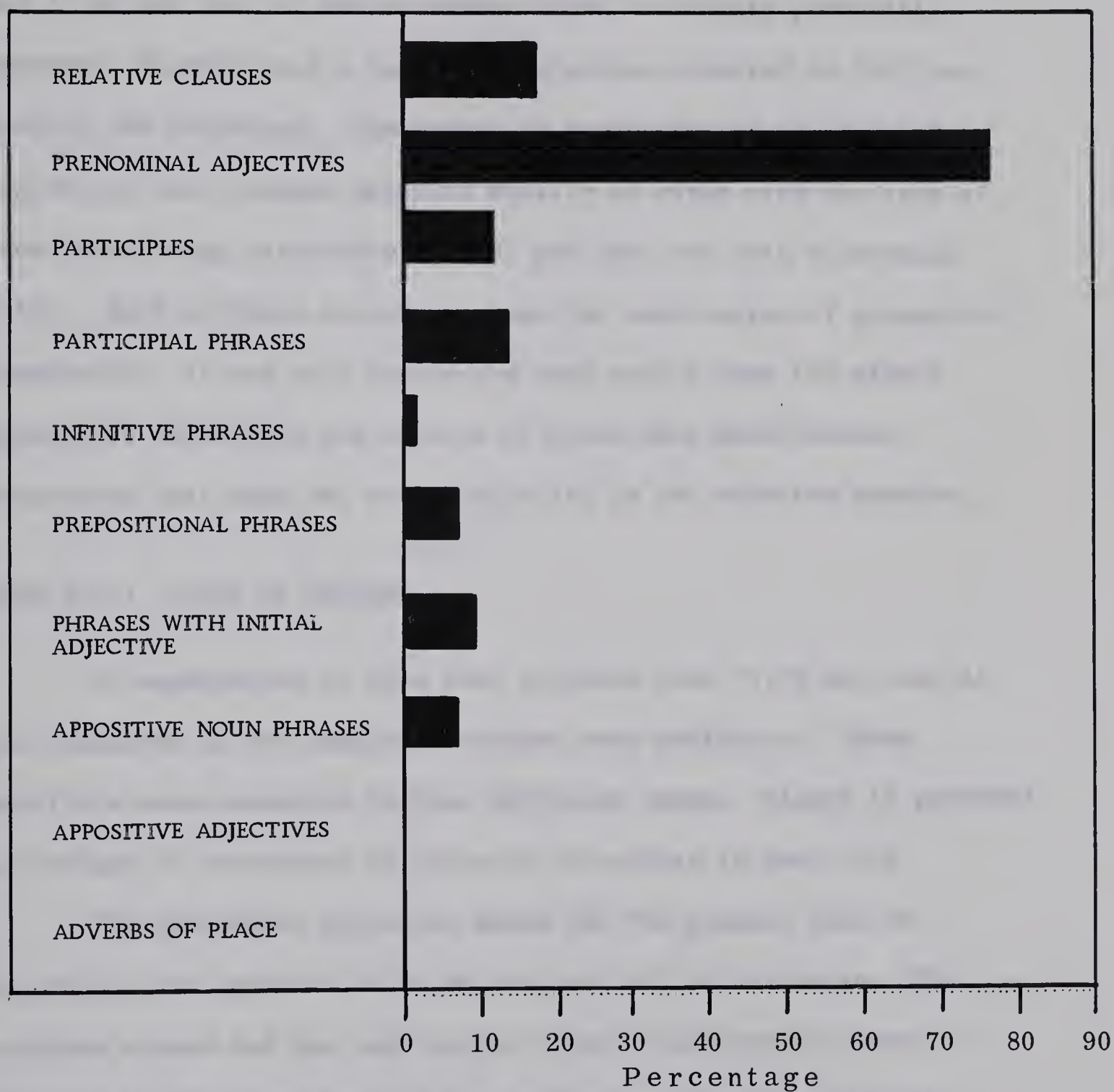


FIGURE 10

PERCENTAGE OF OCCURRENCE OF SELECTED STRUCTURES IN TEXT 10-S



sentences. Participles and participial phrases had the next highest rate of occurrence. Both structures appeared almost as frequently with 12.01 percent of the sentences found to contain participles and 13.94 per cent of the sentences found to contain participial phrases. Phrases with a beginning adjective occurred in 9.13 per cent of the sentences. The number of prepositional phrases and appositive noun phrases appeared equally as often with the rate of occurrence being calculated at 7.21 per cent for both structural units. Both of these structures have the same degree of grammatical complexity. Is one unit understood more easily than the other? Appositive adjectives and adverbs of place were modification structures that were not utilized at all in the selected samples.

Text 11-P: Story of Nations

An examination of this text revealed that 75.38 per cent of the sentences in the samples contained noun modifiers. These modifiers were presented in nine different forms. Figure 11 presents percentage of occurrence of selected structures in text 11-P.

The prenominal adjective again had the highest rate of occurrence and appeared in 63.86 per cent of the sentences. The relative clause had the next highest rate of occurrence since it appeared in 16.19 per cent of the sentences. The prepositional phrase as a noun modification unit was present in 9.03 per cent of the sentences. The participle and participial phrase had almost the same





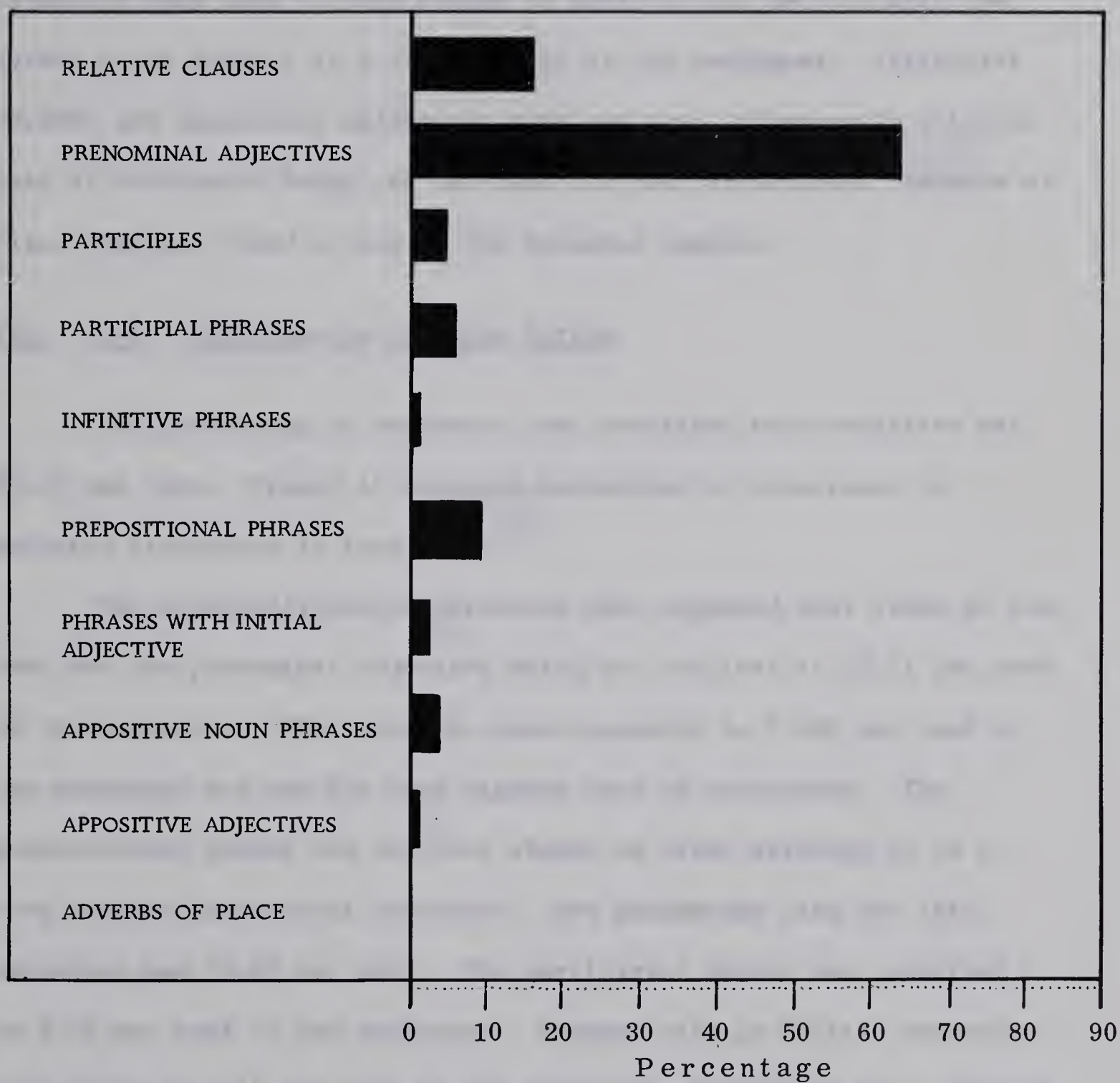


FIGURE 11

PERCENTAGE OF OCCURRENCE OF SELECTED STRUCTURES IN TEXT 11-P



rate of occurrence with 4.98 per cent of the sentences containing the participle and 5.29 per cent of the sentences containing a participial phrase. The appositive noun phrase and phrases with an initial adjective were used to some extent as modification devices with the former being present in 2.18 per cent of the sentences. Infinitive phrases and appositive adjectives were employed infrequently with the rate of occurrence being .62 per cent for both structures. Adverbs of place were not found in any of the selected samples.

Text 11-S: Building the Canadian Nation

The percentage of sentences that contained noun modifiers was 87.75 per cent. Figure 12 presents percentage of occurrence of selected structures in text 11-S.

The noun modification structure that appeared most often in the text was the prenominal adjective which was utilized in 75.51 per cent of the sentences. The relative clause appeared in 19.04 per cent of the sentences and had the next highest rate of occurrence. The prepositional phrase was utilized almost as often although it is a more complex grammatical structure. The percentage rate for this structure was 18.02 per cent. The participial phrase was contained in 8.16 per cent of the sentences. Phrases with an initial adjective were found in 6.12 per cent of the sentences, appositive noun phrases were found in 5.78 per cent of the sentences, and the prenominal participle appeared in 5.44 per cent of the written material.





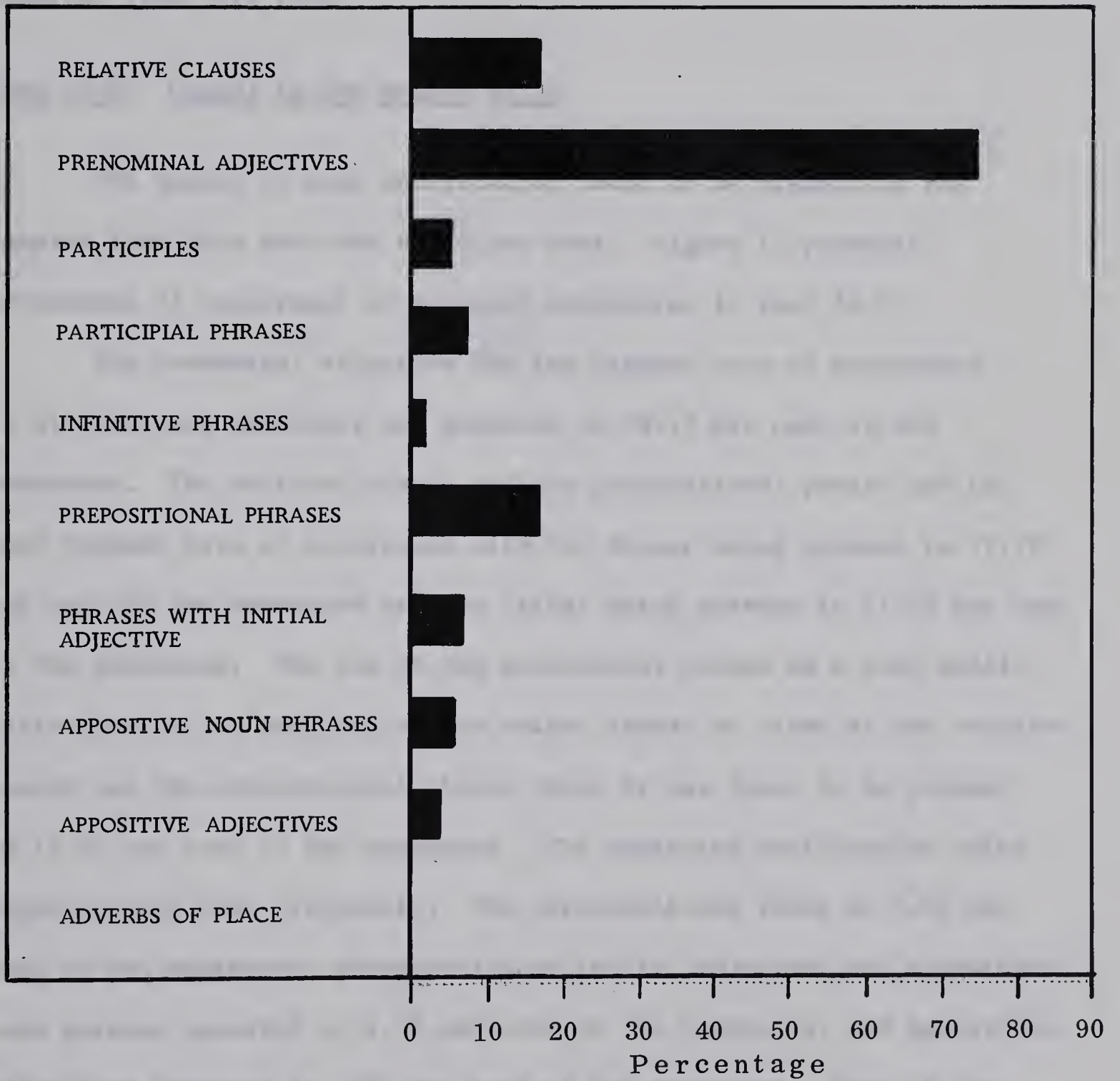
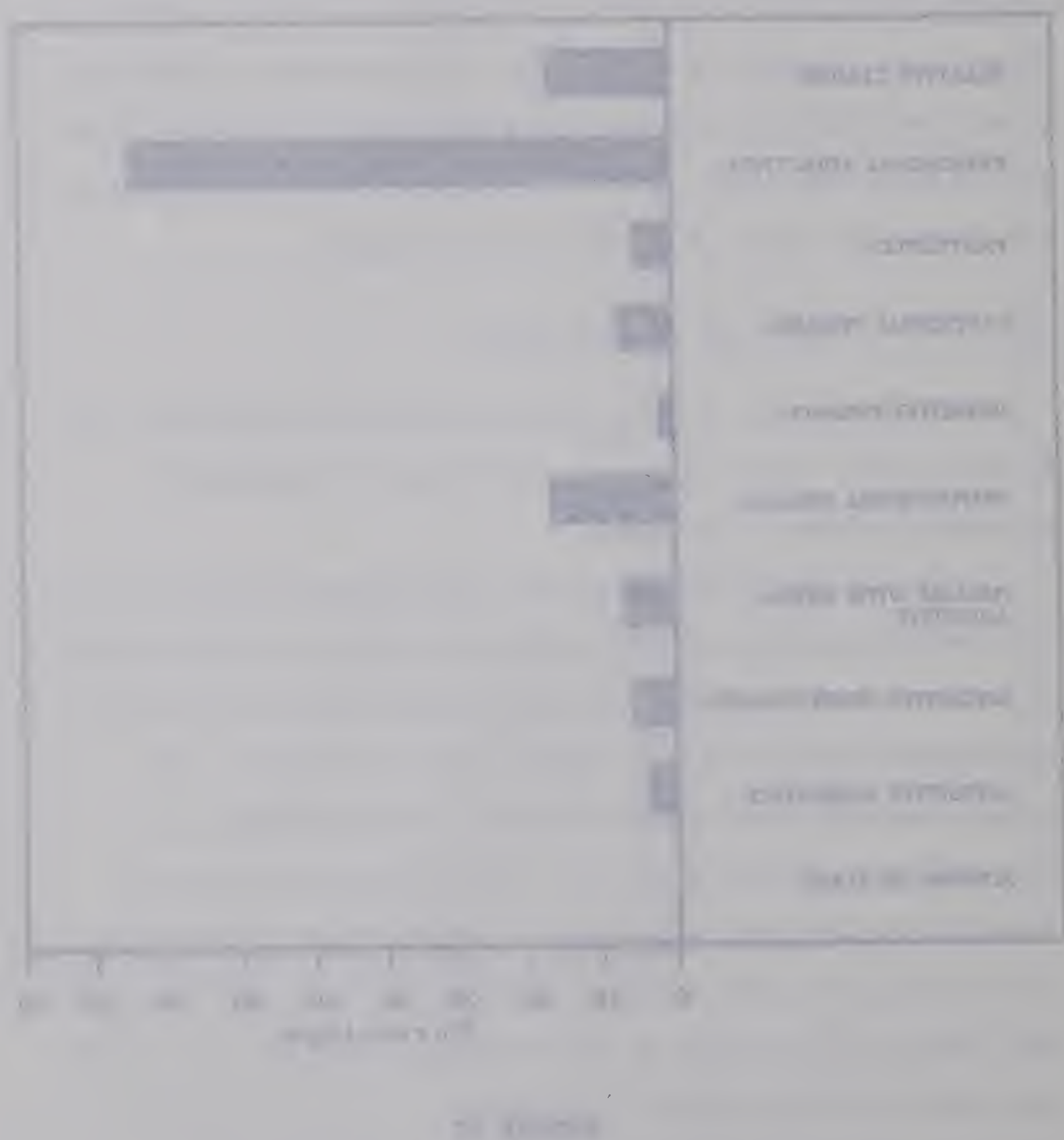


FIGURE 12

PERCENTAGE OF OCCURRENCE OF SELECTED STRUCTURES IN TEXT 11-S



Appositive adjectives were contained in 3.06 per cent of the sentences and infinitive phrases were found in 1.70 per cent of the sentences. The adverb of place was found not to be contained in any of the samples examined from this text.

Text 12-P: Canada in the Modern World

The amount of noun modification found to be present in the samples from this text was 83.24 per cent. Figure 13 presents percentage of occurrence of selected structures in text 12-P.

The prenominal adjective had the highest rate of occurrence of all the noun modifiers and appeared in 78.17 per cent of the sentences. The relative clause and the prepositional phrase had the next highest rate of occurrence with the former being present in 17.76 per cent of the sentences and the latter being present in 17.25 per cent of the sentences. The use of the participial phrase as a noun modification device was employed by the author almost as often as the relative clause and the prepositional phrase since it was found to be present in 15.22 per cent of the sentences. The remaining modification units appeared much less frequently. The participle was found in 7.61 per cent of the sentences, phrases with an initial adjective and appositive noun phrases appeared in 2.53 per cent of the sentences, and appositive adjectives appeared in .507 per cent of the sentences. None of the sentences examined contained an adverb of place as a modifier of a noun.





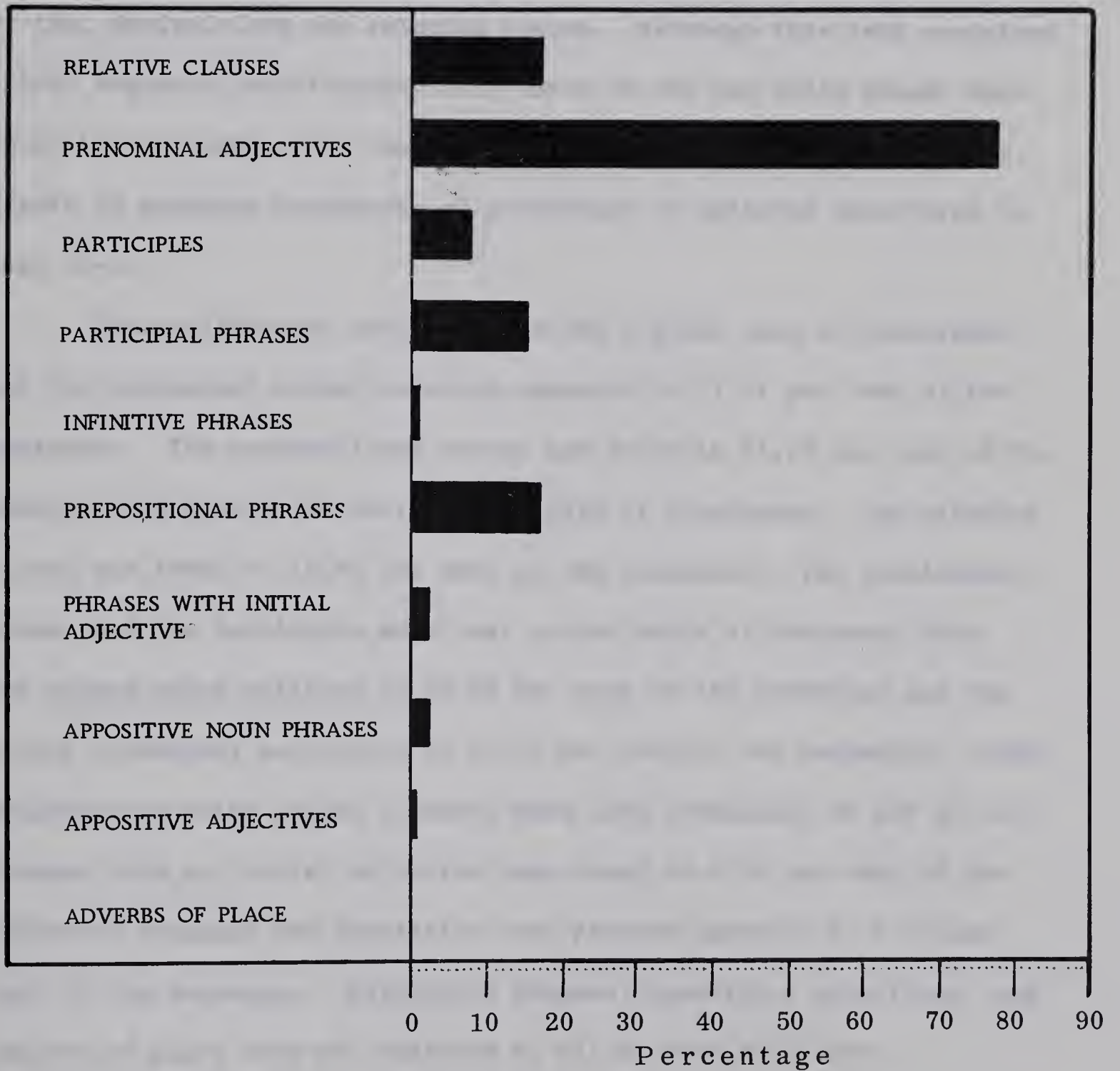


FIGURE 13

PERCENTAGE OF OCCURRENCE OF SELECTED STRUCTURES IN TEXT 12-P



Text 12-S: Your Local Government

An examination of this text revealed that 85.50 per cent of the sentences examined contained noun modifiers that were relative clauses or that derived from the relative clause. Although this text contained a high degree of modification only seven of the ten units sought were found to be present. Of these units only five were used extensively. Figure 14 presents percentage of occurrence of selected structures in text 12-S.

The modification unit that had the highest rate of occurrence was the prenominal adjective which appeared in 71.01 per cent of the sentences. The prepositional phrase was found in 21.73 per cent of the material and showed the next highest rate of occurrence. The relative clause was found in 18.84 per cent of the sentences. The participial phrase and the participle were next on the scale of frequency with the phrase being utilized in 13.04 per cent of the sentences and the single prenominal participle in 11.59 per cent of the sentences. Other modification units sought appeared much less frequently or not at all. Phrases with an initial adjective were found in 4.34 per cent of the sentences examined and appositive noun phrases appeared in 1.44 per cent of the sentences. Infinitive phrases, appositive adjectives, and adverbs of place were not employed at all as noun modifiers.





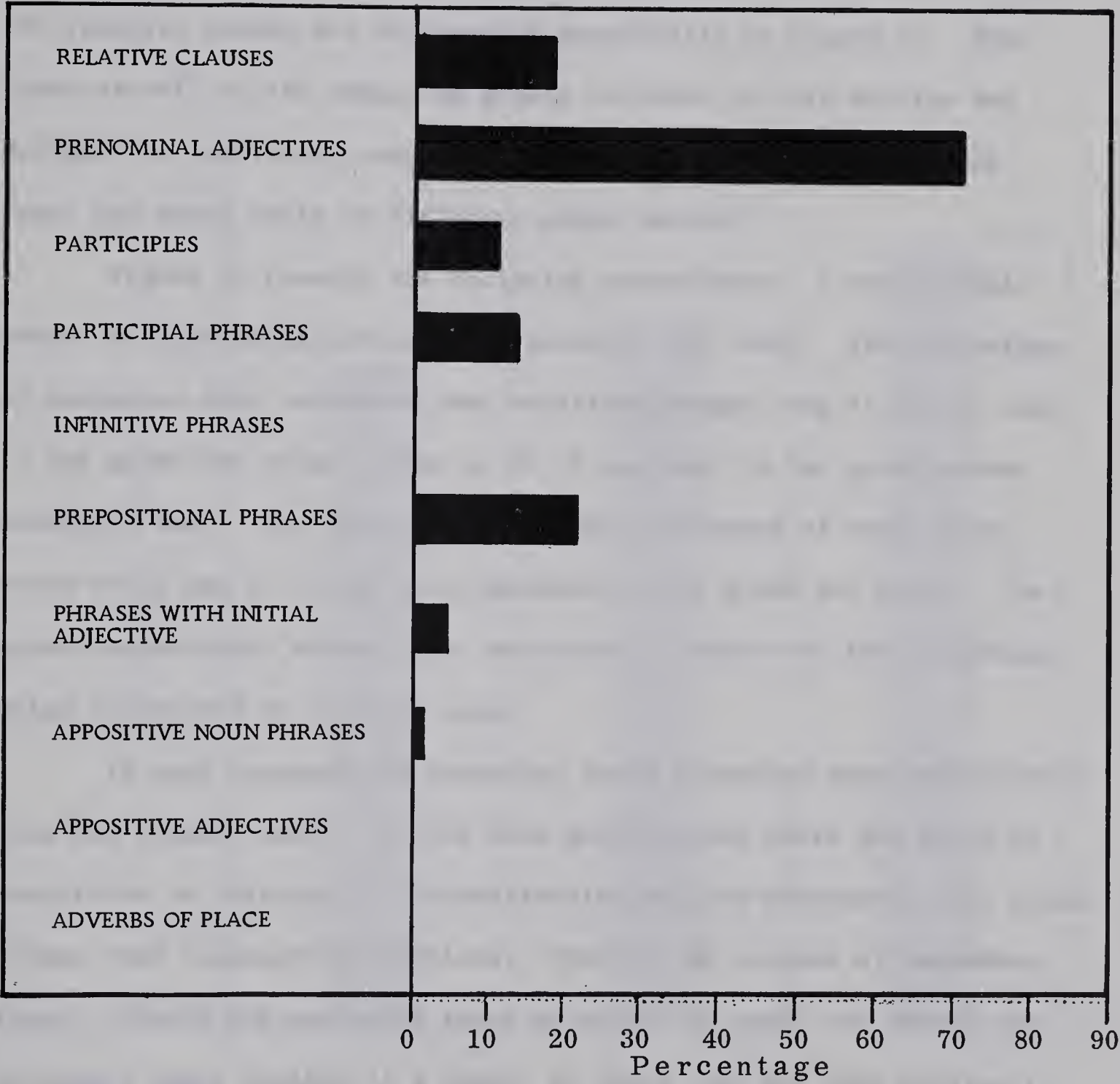


FIGURE 14

PERCENTAGE OF OCCURRENCE OF SELECTED STRUCTURES IN TEXT 12-S



### III. PERCENTAGE SCORES: COMPARISON OF TEXTBOOKS

The percentage of sentences in all texts that were found to contain noun modifiers that are relative clauses or that derive from the relative clause are represented graphically in Figure 15. This graph as well as the remaining graphs included in this section are designed to facilitate comparison between texts at the same grade level and among texts at different grade levels.

Figure 15 reveals the following comparisons. A considerable amount of noun modification was present in all texts. The percentage of sentences that contained noun modifiers ranged from 71.43 per cent in the grade ten primary text to 87.75 per cent in the grade eleven secondary text. The widest range in the occurrence of these structures which was 15.10 per cent appeared at the grade ten level. The grade twelve texts showed less variation in range with the difference being calculated at 2.26 per cent.

In each instance the secondary texts contained more modification than the primary texts. If the noun modification units are found to contribute to difficulty of understanding written discourse, this trend raises some interesting questions. What is the purpose of secondary texts? Should the secondary texts be easier to read? Or should the secondary texts consist of a number of texts that are most difficult than the primary texts in order to provide challenge for the brighter student and a number of texts that are easy reading so that the less gifted student will avoid frustration when attempting to work beyond





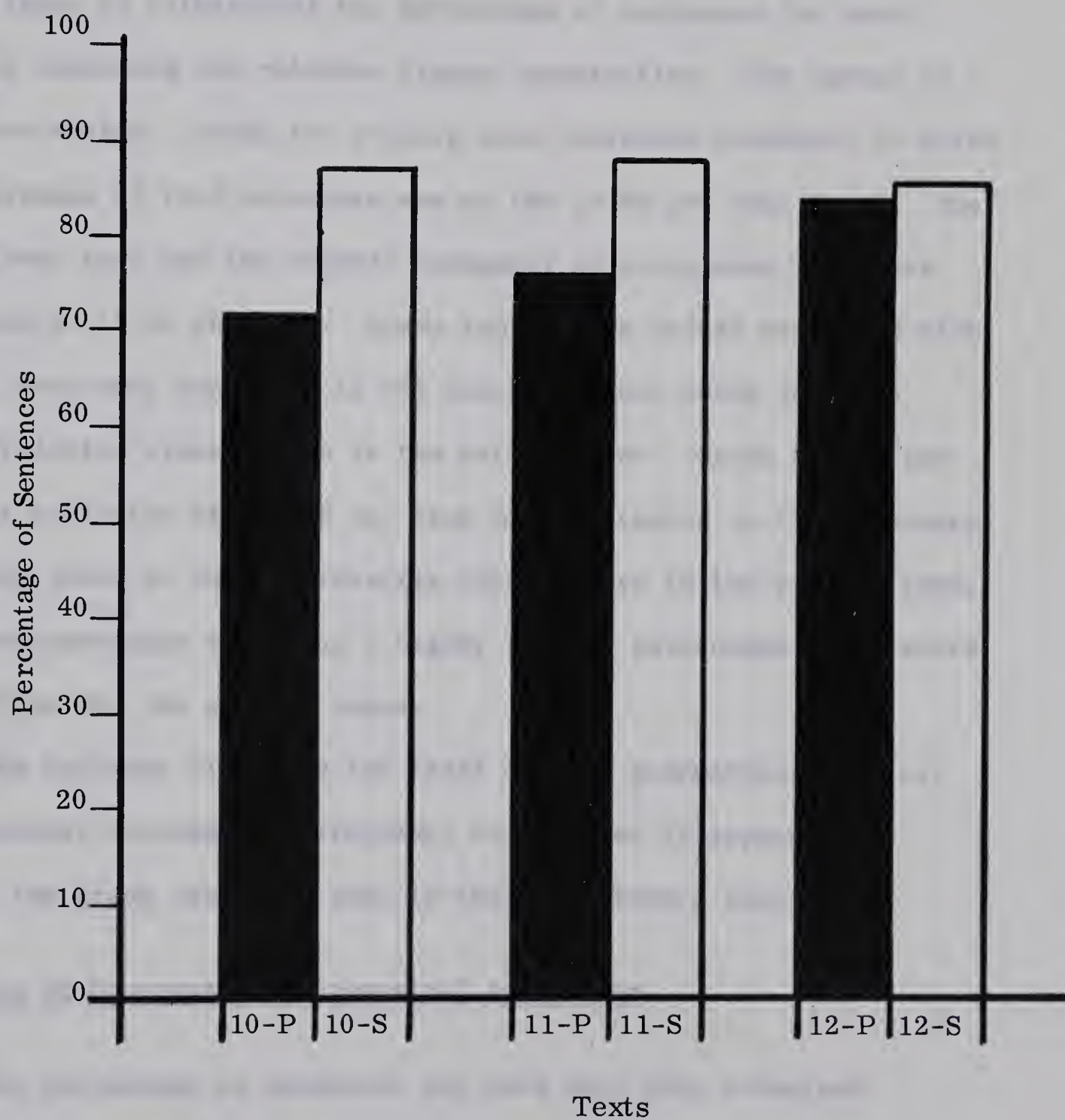


FIGURE 15

PERCENTAGE OF SENTENCES CONTAINING MODIFIERS



one primary text. At present the secondary texts are not graded according to difficulty.

#### Comparison of Occurrence of Relative Clauses

Figure 16 illustrates the percentage of sentences for each text that contained the relative clause construction. The amount of occurrence varied. Grade ten primary text contained sentences in which the occurrence of this structure was at the 10.88 per cent level. The grade eleven text had the highest frequency of occurrence which was calculated at 19.04 per cent. Grade ten had the widest variation with 6.90 per cent more sentences in the secondary text being found to contain relative clauses than in the primary text. Grade twelve had the least variation with 1.08 per cent more sentences in the secondary text being found to contain relative clauses than in the primary text. All of the secondary texts had a higher rate of percentage of relative clauses than did the primary texts.

The relative clause is the least complex grammatically of all the structures included for frequency counts, yet it appears less often in the grade ten texts than in the grade twelve texts.

#### Comparison of Occurrence of Prenominal Adjectives

The percentage of sentences for each text that contained prenominal modifiers is given in Figure 17.





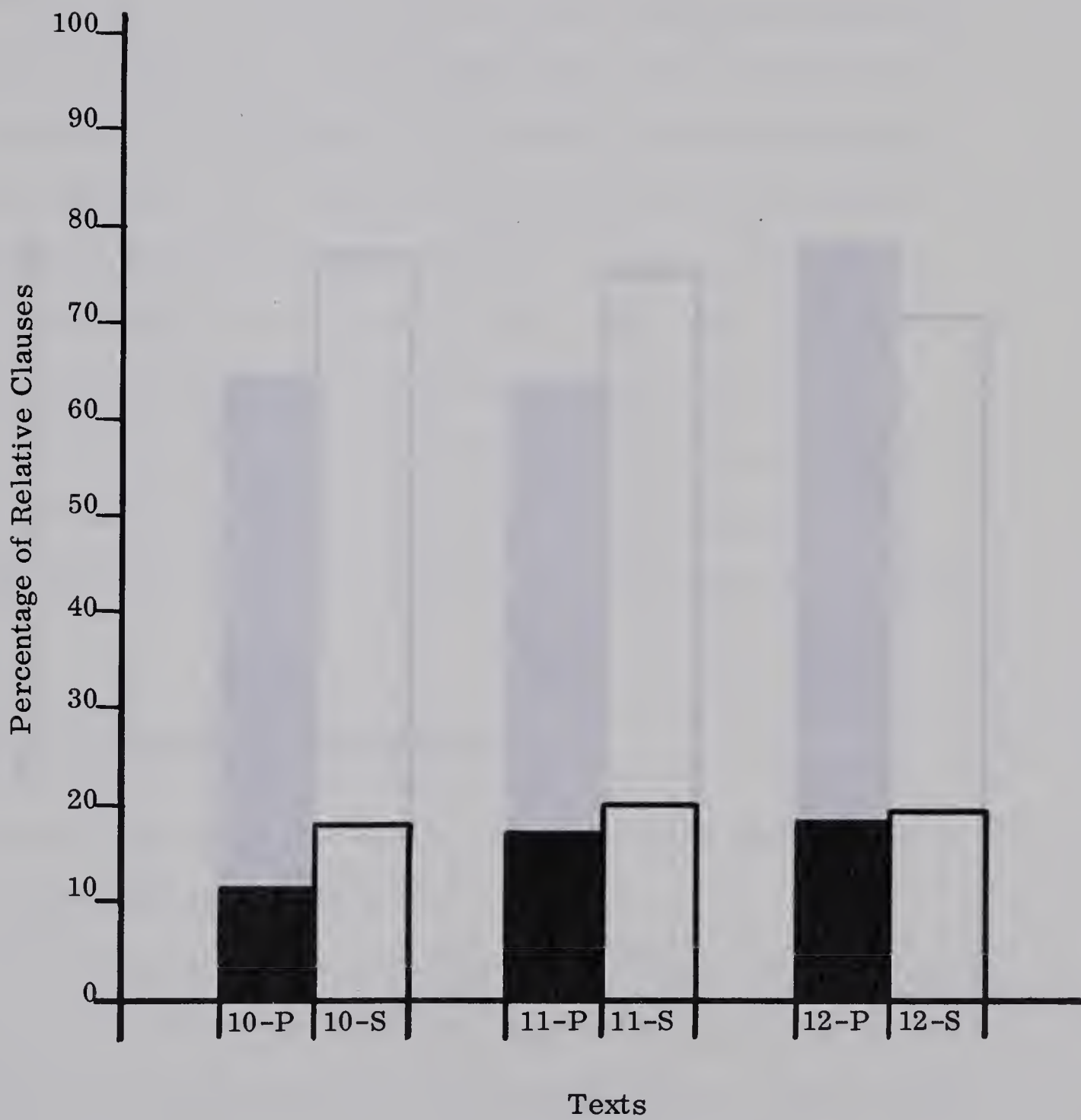


FIGURE 16

PERCENTAGE OF SENTENCES CONTAINING RELATIVE CLAUSES



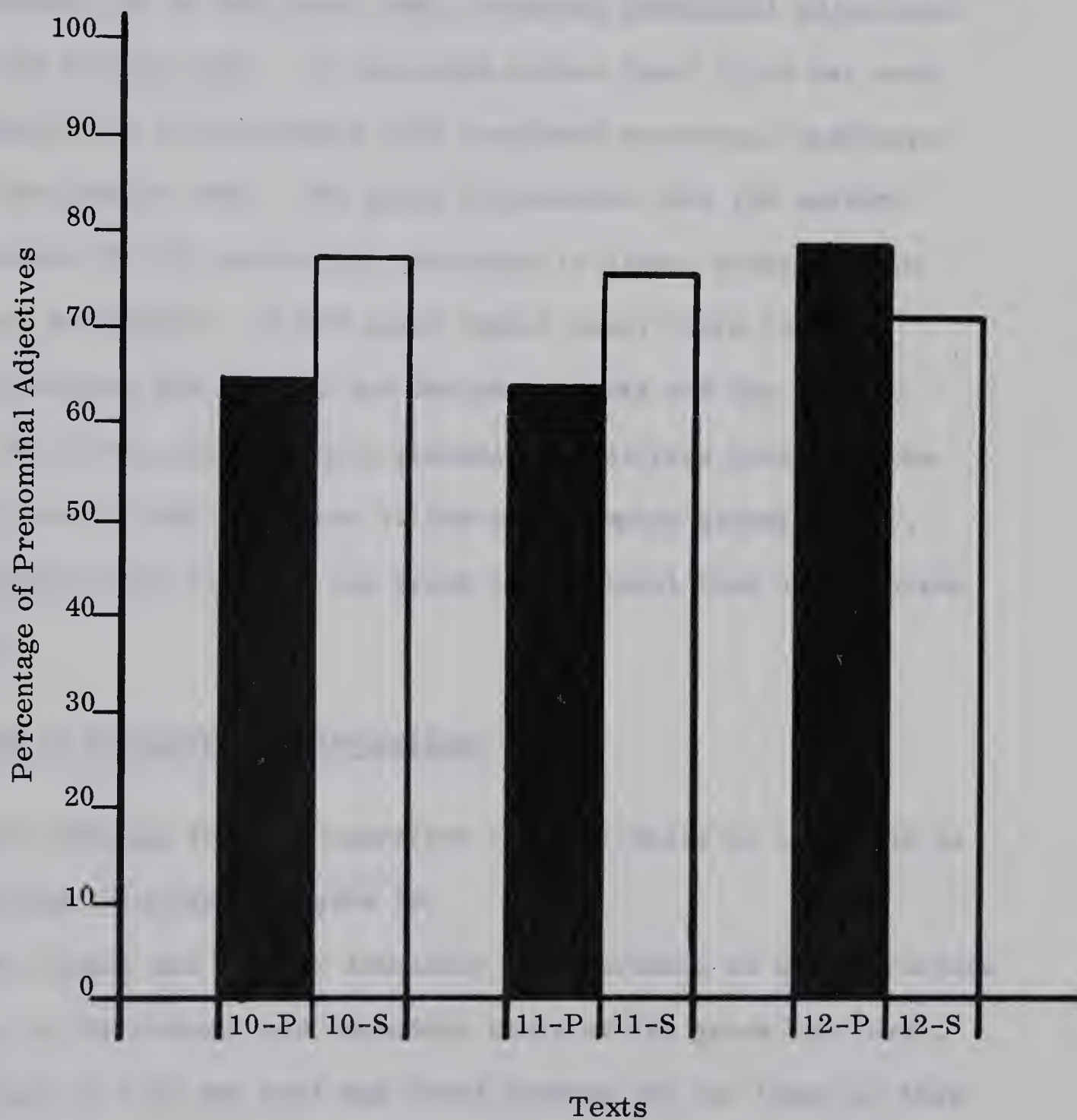


FIGURE 17

PERCENTAGE OF SENTENCES  
CONTAINING PRENOMINAL ADJECTIVES





Each text examined contained a considerable number of sentences that had one or more prenominal adjectives as a noun modifier. The texts in grades ten and eleven had the widest variation in frequency of occurrence of this structure. At the grade ten level 12.30 per cent more sentences in the secondary text contained prenominal adjectives than in the primary text. At the grade eleven level 11.65 per cent more sentences in the secondary text contained prenominal modifiers than in the primary text. The graph illustrates that the pattern of occurrence of this particular structure is almost identical in grades ten and eleven. At the grade twelve level there is less variation between the primary and secondary texts and the primary text at this level contains more prenominal modifiers than does the secondary text. This structure is the most complex grammatically, yet it appears less often at the grade eleven level than at the grade ten level.

#### Comparison of occurrence of participles

The findings for the occurrence of participles in sentences in the six texts is given in Figure 18.

The lowest and highest frequency of occurrence of this structure was found in the primary and secondary texts at the grade ten level. A difference of 7.25 per cent was found between the two texts at this level with more participles found in the secondary text than in the primary text. The grade eleven texts showed almost identical occurrence. The pattern found in grade twelve texts more nearly



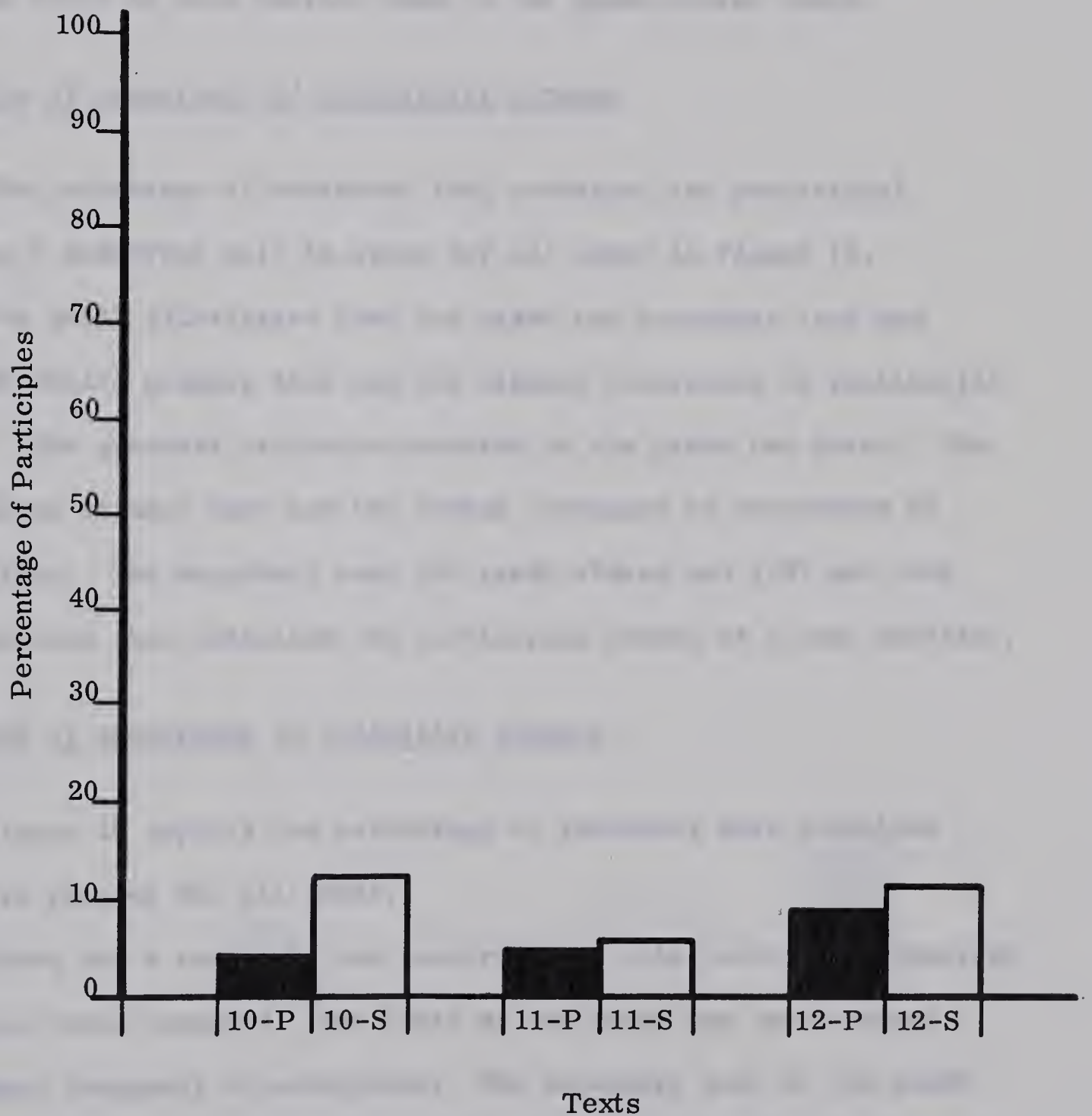


FIGURE 18

PERCENTAGE OF SENTENCES CONTAINING PARTICIPLES





resembles the pattern found at grade ten level. The secondary text contains more modifiers than the primary text and the percentage of modifiers in the ten and twelve secondary texts is almost identical. This is a deeply embedded structure. However its occurrence in the grade ten texts is much heavier than in the grade eleven texts.

#### Comparison of occurrence of participial phrases

The percentage of sentences that contained the participial phrase as a modifying unit is given for all texts in Figure 19.

The graph illustrates that the grade ten secondary text and the grade twelve primary text had the highest occurrence of participial phrases. The greatest variation occurred at the grade ten level. The grade eleven primary text had the lowest frequency of occurrence of the modifier. The secondary text for grade eleven had 2.87 per cent more sentences that contained the participial phrase as a noun modifier.

#### Comparison of occurrence of infinitive phrases

Figure 20 depicts the percentage of sentences that contained infinitive phrases for all texts.

There was a regularly low occurrence of this particular structure in all the texts examined. The texts at the grade ten level showed the highest frequency of occurrence. The secondary text at the grade twelve level showed no occurrence of the infinitive phrase as a noun modifier. This syntactic unit was present in the grade eleven texts but the use made of this type of structure as a noun modifier is very



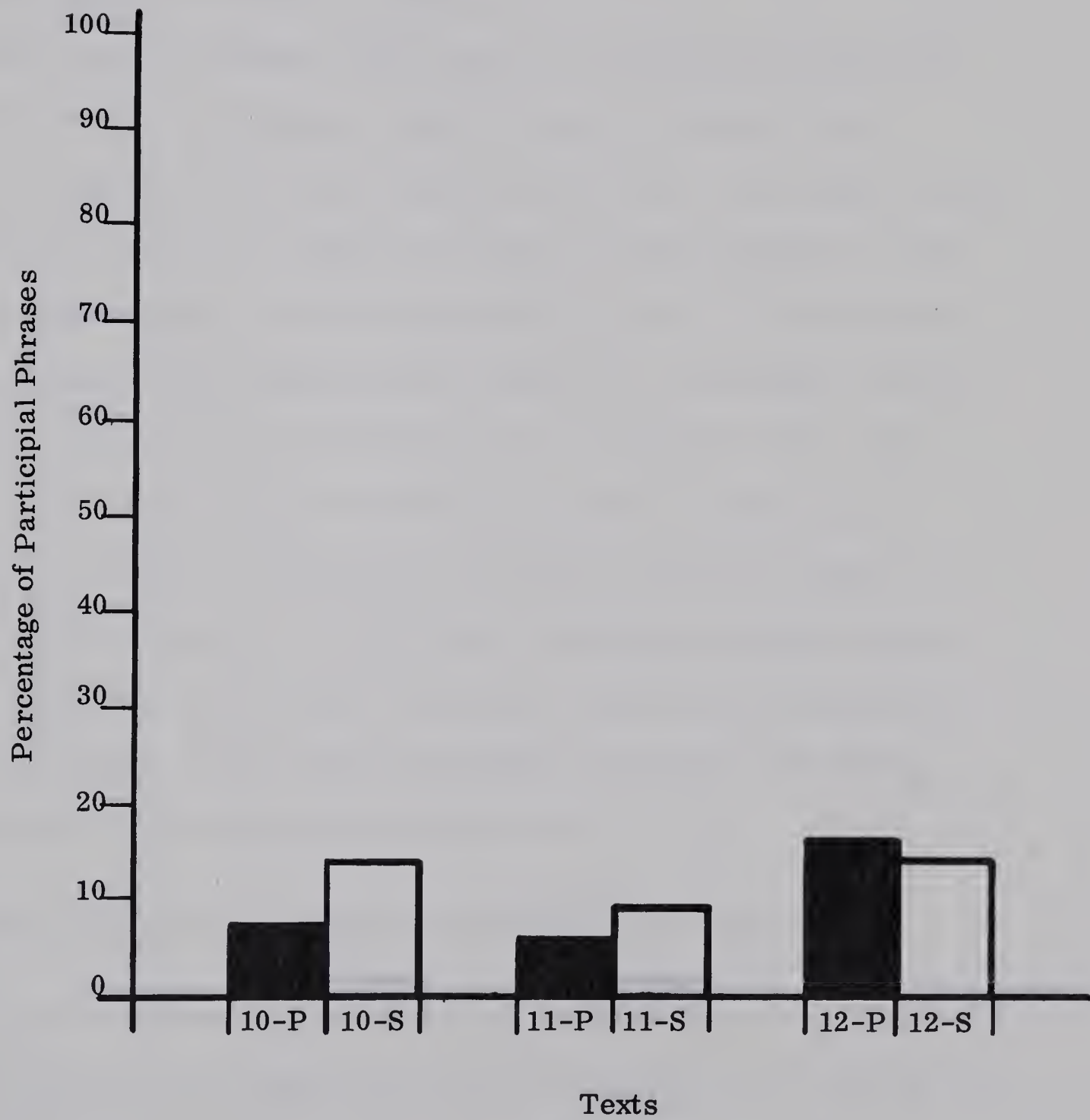


FIGURE 19

PERCENTAGE OF SENTENCES  
CONTAINING PARTICIPIAL PHRASES





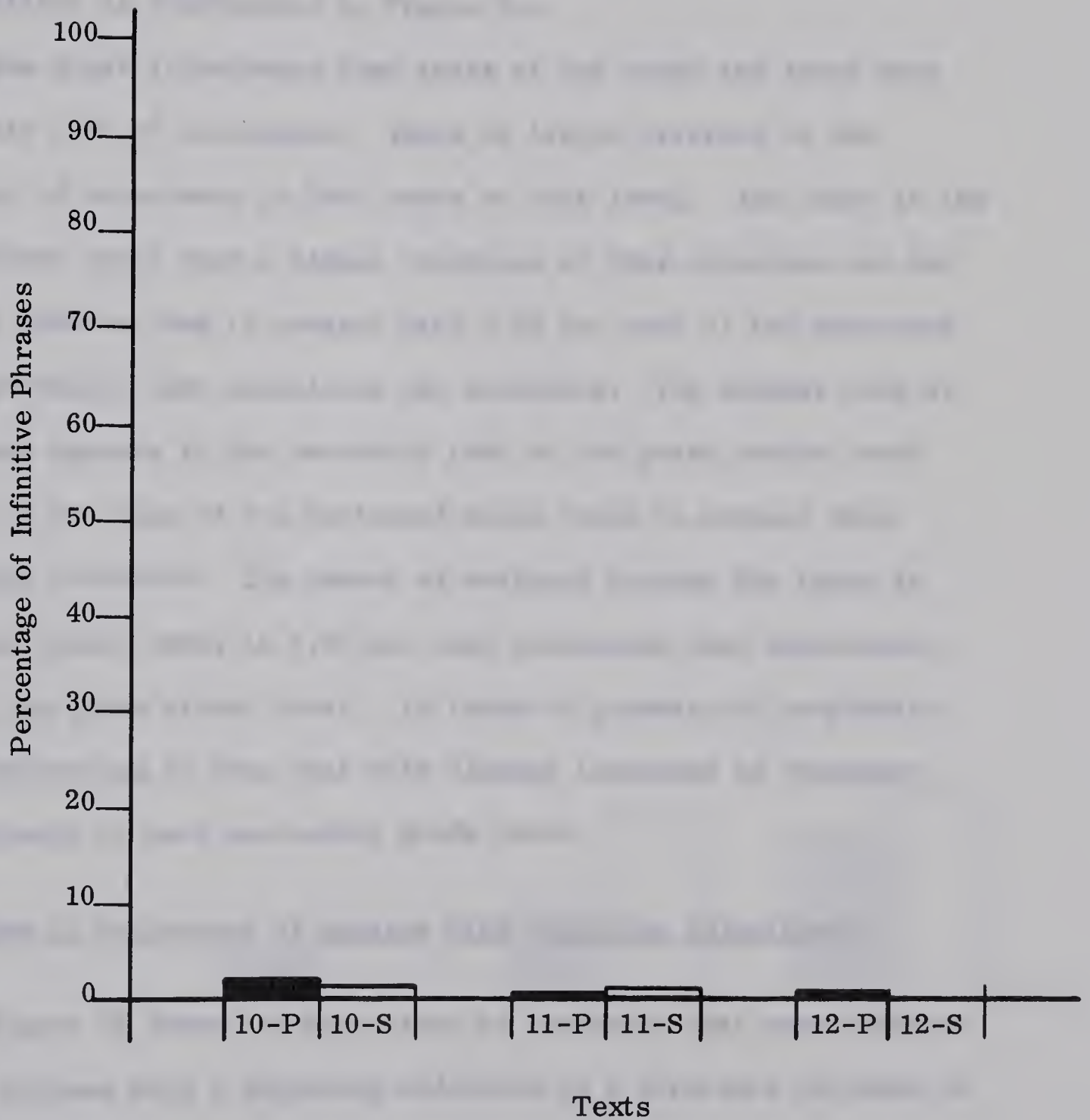


FIGURE 20

PERCENTAGE OF SENTENCES CONTAINING INFINITIVE PHRASES



limited in these texts as well as in the remaining texts.

#### Comparison of occurrence of prepositional phrases

The frequency of occurrence of the prepositional phrase as a noun modifier is represented in Figure 21.

The graph illustrates that texts at the grade ten level have the lowest rate of occurrence. There is little variance in the frequency of occurrence in both texts at this level. The texts at the grade eleven level show a higher incidence of this structure and the variance between them is greater with 8.99 per cent of the sentences in the secondary text containing the structure. The highest rate of occurrence appears in the secondary text at the grade twelve level with 21.73 per cent of the sentences being found to contain this particular structure. The amount of variance between the texts at the grade twelve level is 4.88 per cent indicating less discrepancy than at the grade eleven level. In terms of grammatical complexity it is interesting to note that this element increases in frequency of occurrence at each succeeding grade level.

#### Comparison of occurrence of phrases with beginning adjectives

Figure 22 shows the percentage of sentences that were found to contain phrases with a beginning adjective as a structure utilized in noun modification.

The graph indicates that both the highest and lowest rate of





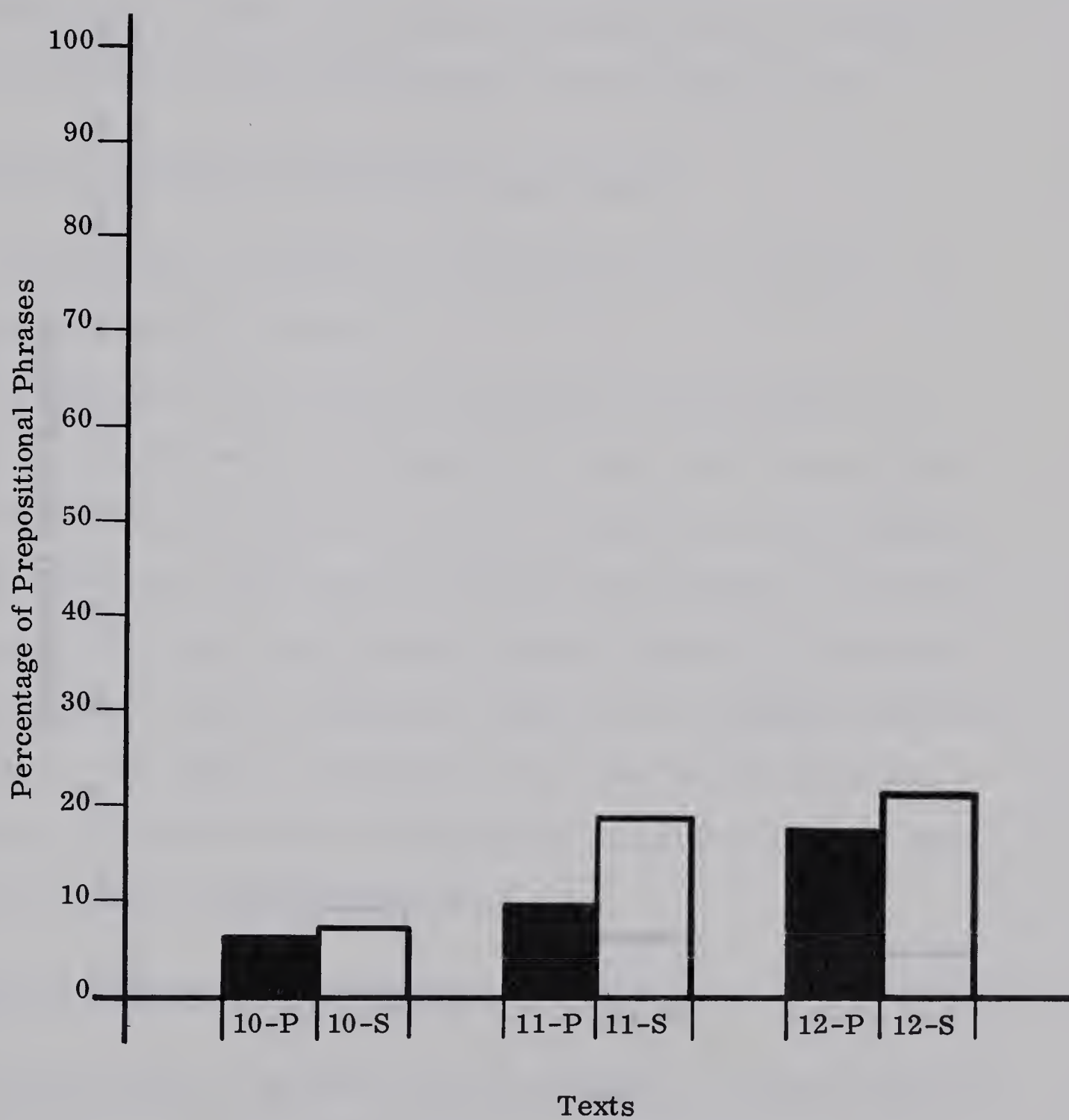


FIGURE 21

PERCENTAGE OF SENTENCES  
CONTAINING PREPOSITIONAL PHRASES



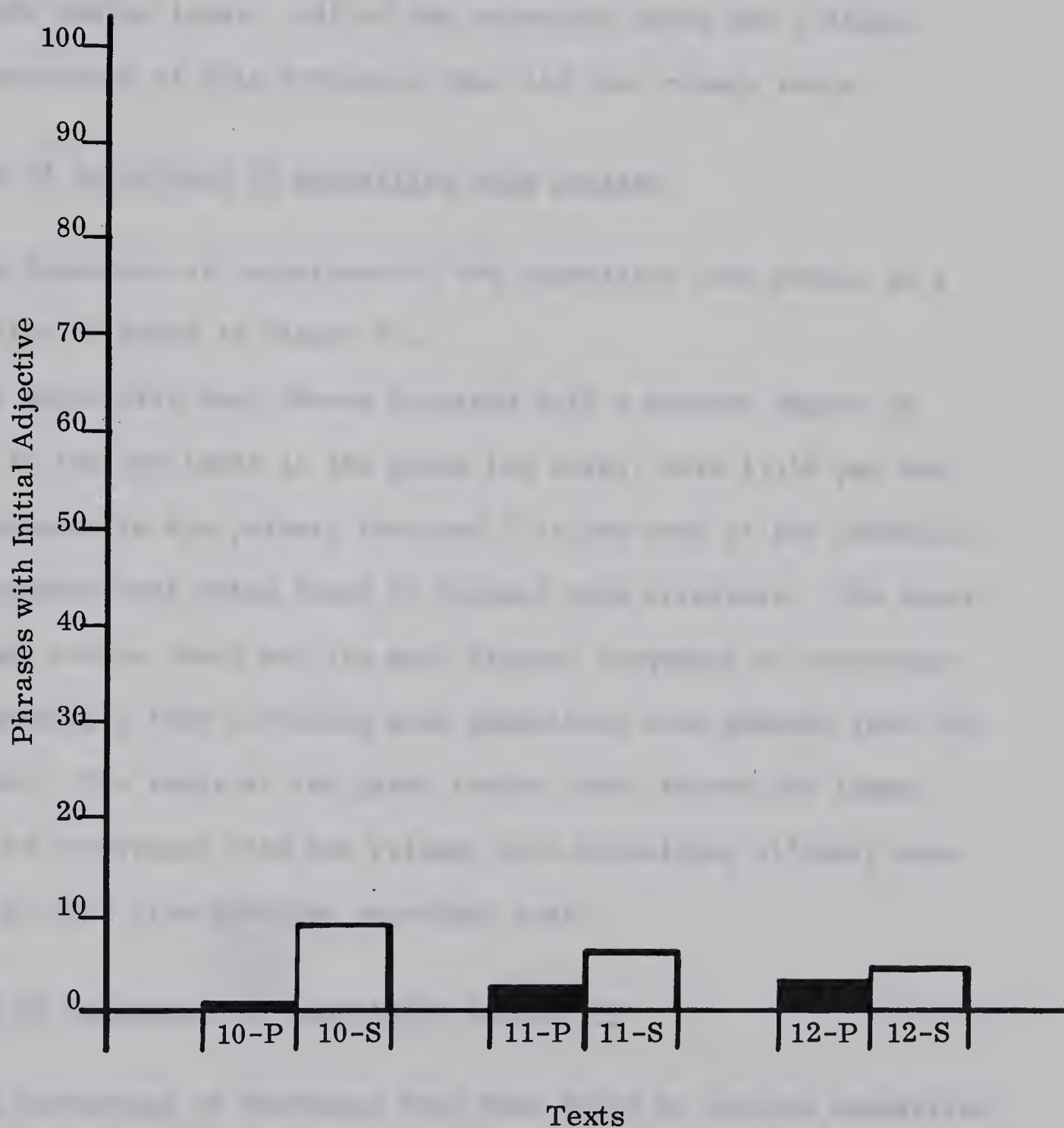


FIGURE 22

PERCENTAGE OF SENTENCES  
CONTAINING PHRASES WITH INITIAL ADJECTIVE





occurrence was found in texts at the grade ten level with the primary text having .68 per cent of the sentences containing the structure and the secondary text having 9.13 per cent of the sentences containing the structure. The lowest degree of variance was found between texts at the grade twelve level. All of the secondary texts had a higher rate of occurrence of this structure than did the primary texts.

#### Comparison of occurrence of appositive noun phrases

The frequency of occurrence of the appositive noun phrase as a noun modifier is shown in Figure 23.

The appositive noun phrase occurred with a greater degree of frequency in the two texts at the grade ten level, with 11.56 per cent of the sentences in the primary text and 7.21 per cent of the sentences in the secondary text being found to contain this structure. The texts at the grade eleven level had the next highest frequency of occurrence with the secondary text providing more appositive noun phrases than the primary text. The texts at the grade twelve level showed the lowest frequency of occurrence with the primary text containing slightly more modifiers of this type than the secondary text.

#### Comparison of occurrence of appositive adjectives

The percentage of sentences that were found to contain appositive adjectives is depicted in graphic representation in Figure 24.

The employment of appositive adjectives as noun modifiers in



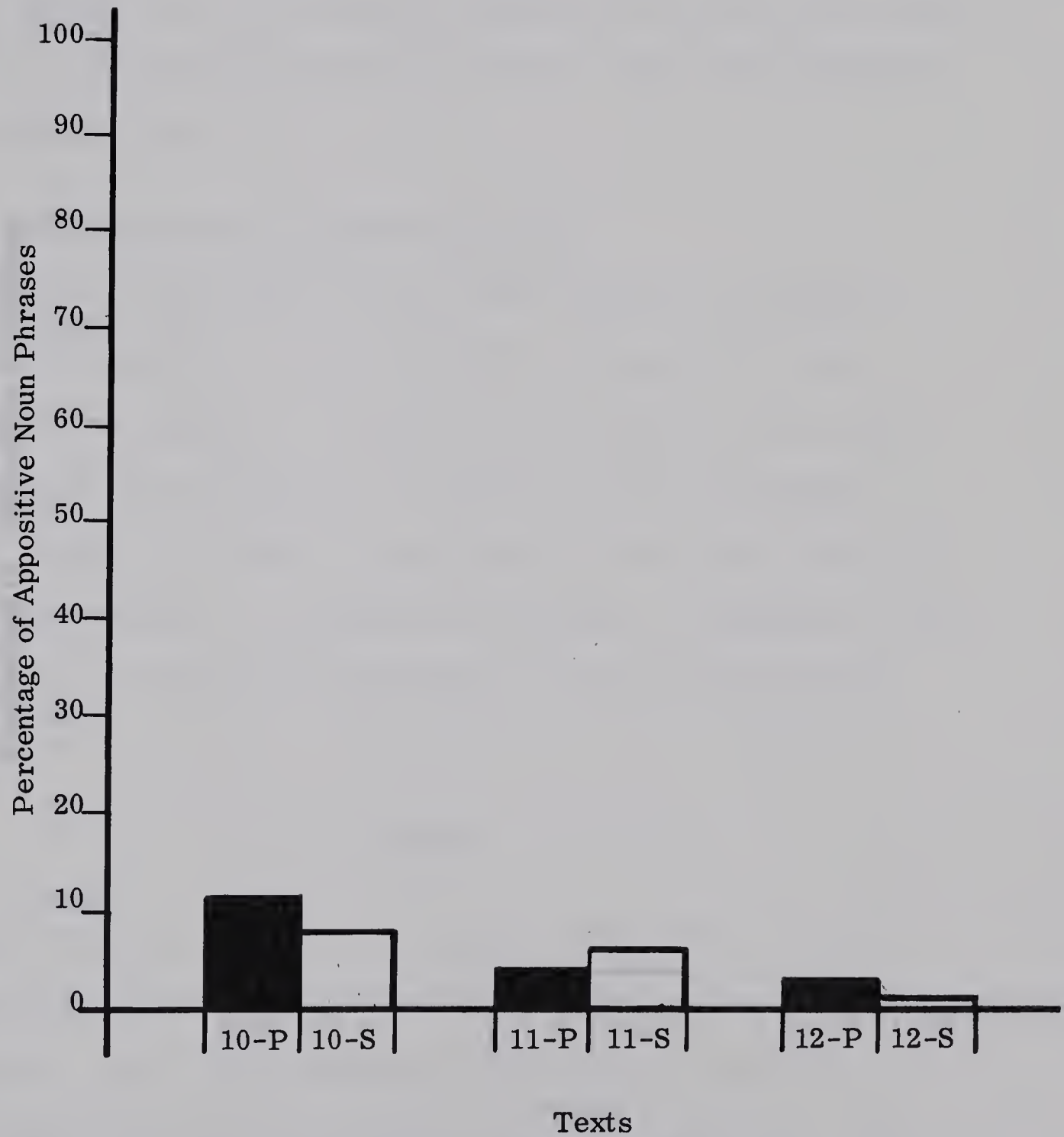


FIGURE 23

PERCENTAGE OF SENTENCES  
CONTAINING APPOSITIVE NOUN PHRASES





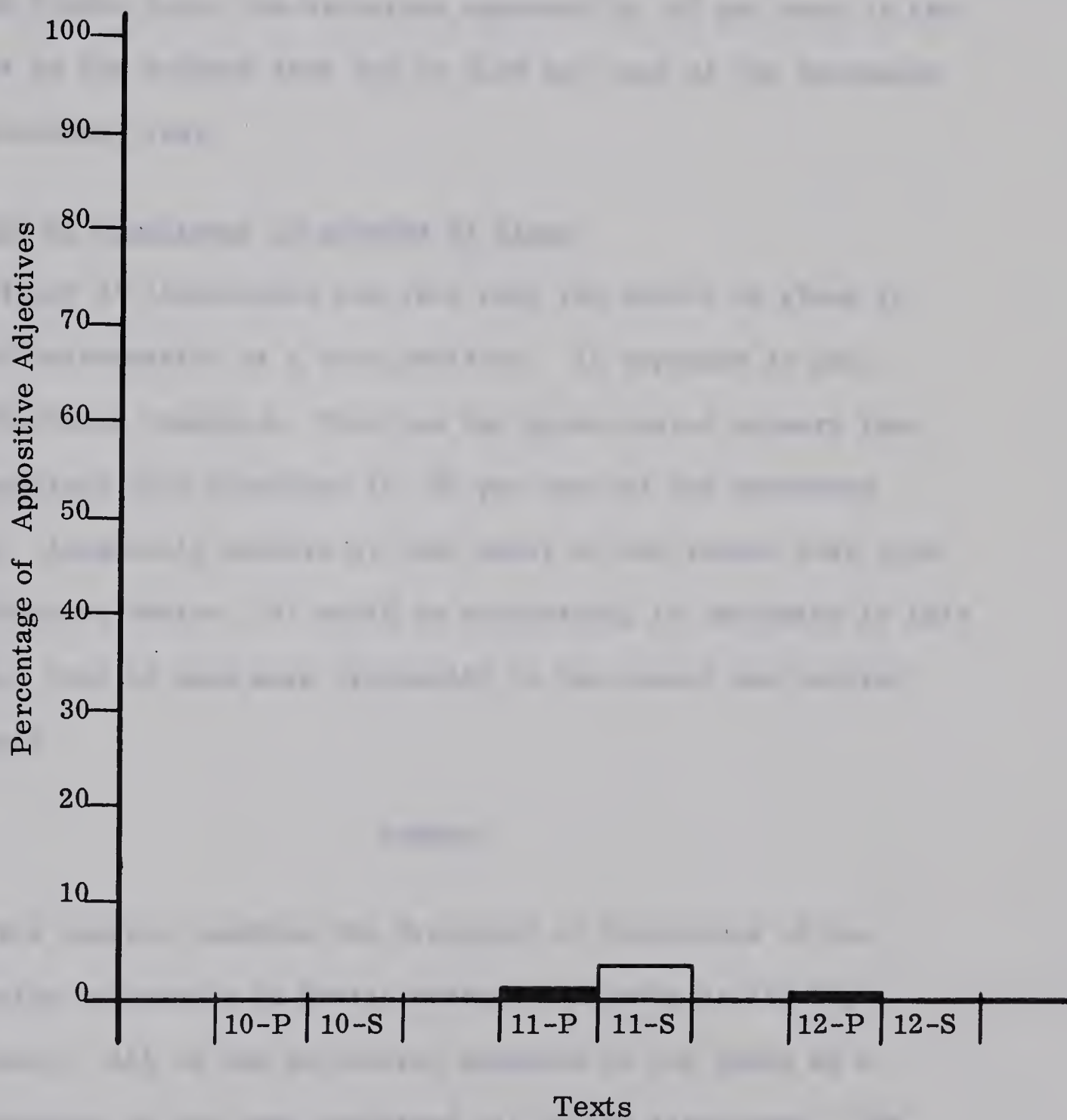


FIGURE 24

PERCENTAGE OF SENTENCES CONTAINING APPOSITIVE ADJECTIVES



written discourse is shown in the graph to be infrequent. In the grade ten texts and in the secondary text at the grade twelve level the structure did not appear at all. In the grade twelve primary text the structure appeared in .50 per cent of the sentences. In the grade eleven texts the structure appeared in .62 per cent of the sentences in the primary text and in 3.06 per cent of the sentences in the secondary text.

#### Comparison of occurrence of adverbs of place

Figure 25 illustrates the fact that the adverb of place is used most infrequently as a noun modifier. It appeared in only one of the texts examined. This was the grade twelve primary text which contained this structure in .50 per cent of the sentences examined. Apparently authors of text books do not favour this type of modification device. It would be interesting to determine if this particular unit is used more frequently in the speech and writing of students.

#### SUMMARY

This chapter examined the frequency of occurrence of ten modification structures in social studies textbooks at the high school level. All of the structures appeared in the texts as a group. However no one text contained all of the structures. The modification units were used with varying degrees of frequency, ranging from 78.17 per cent to less than 1 per cent. The most





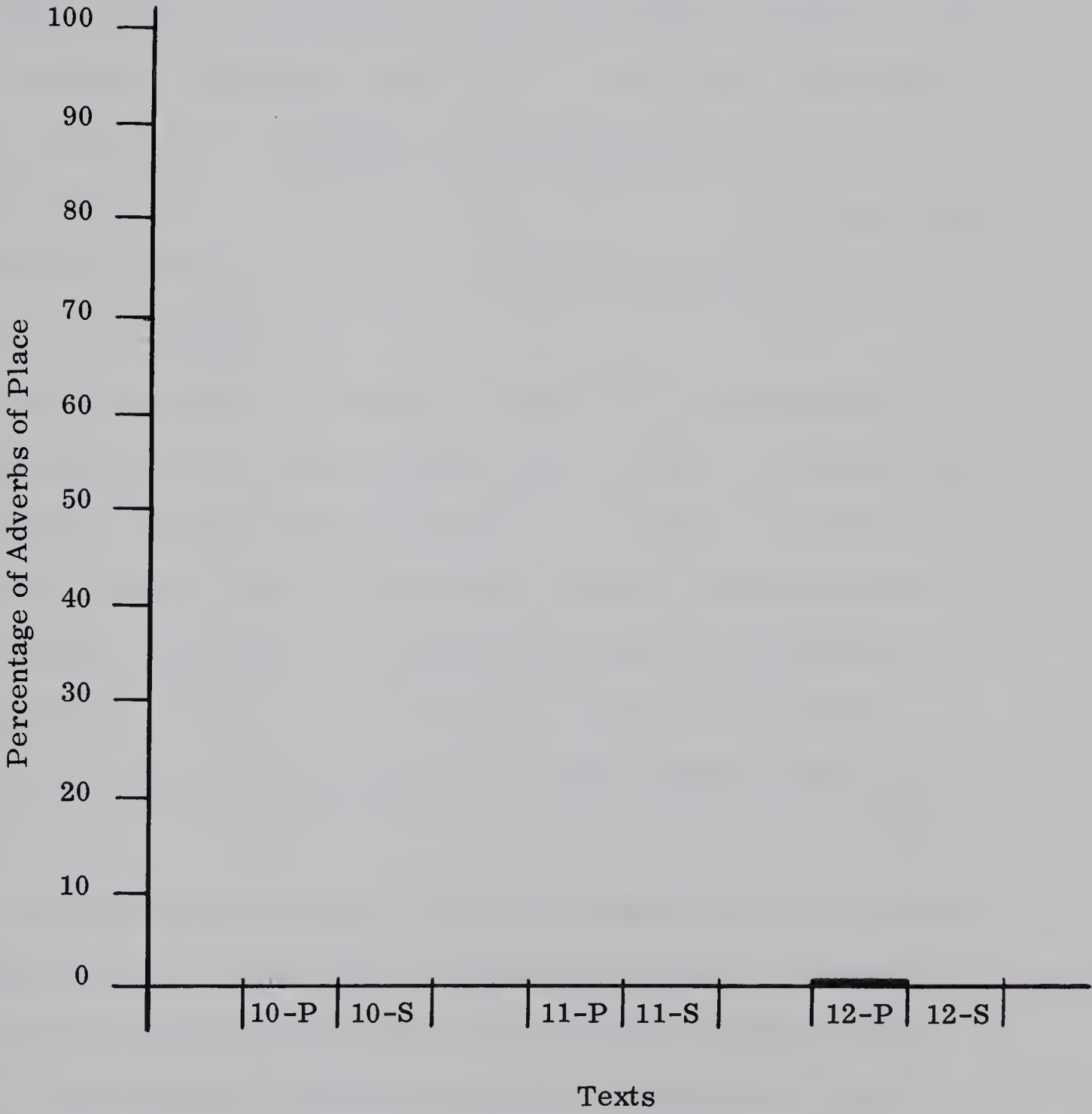


FIGURE 25

PERCENTAGE OF SENTENCES CONTAINING ADVERBS OF PLACE



grammatically complex of all modifiers, the prenominal adjective, was found in all texts with a high degree of frequency as well as the least complex grammatical structure, the relative clause.





## CHAPTER VI

### SUMMARY OF FINDINGS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate a specific factor, that of sentence complexity, which has been empirically determined to be a contributor to difficulty in comprehending written discourse. Research indicated that the techniques utilized in past studies have not measured effectively the contribution that language structure makes to reading difficulty.

An investigation of Chomsky's theory of transformational grammar indicated that this technique might provide a valuable method for examining sentence complexity since it provides an explicit description which reveals and expresses the basic regularities of the language. This theory of language provided the rationale for an examination of noun modification and a determination of the frequency of occurrence of structures of noun modification in textbooks.

In this study, a primary and a secondary social studies text at grade ten, eleven, and twelve levels were examined in order to determine how frequently selected noun modifiers appeared in the texts. These modifiers had been assigned a description in terms of Chomsky's grammar. This grammar illustrates the fact that nearly all noun modifiers in English are either relative clauses or derive



from the relative clause. In addition, it provides a method for determining grammatical complexity and shows the syntactical as well as the functional relationship that exists among noun modification structures. The data provided by the analysis were presented in Chapter V to show the amount and kinds of noun modification that were present in the texts.

### I. SUMMARY OF THE FINDINGS

The use of Chomsky's model of a transformational-generative grammar is an effective tool for identifying and describing syntactical elements and for expressing the relationship that exists among noun modification structures.

All of the predetermined modification units were found in the text. However they occurred with differing degrees of frequency.

The prenominal adjective was the structure that appeared most frequently in all texts. This structure is the most complex grammatically since it is more deeply embedded than the other structures with the exception of the prenominal participle which has the same degree of embedding as the prenominal adjective.

The relative clause, the prepositional phrase, the participial phrase, the participle, the appositive noun phrase, and the phrase with an initial adjective follow in frequency of occurrence.

The infinitive phrase, the appositive adjective, and the







adverb of place are structures that were used infrequently or not at all as noun modifiers.

Grade twelve texts are the most complex grammatically since they contain a higher percentage of the more deeply embedded structures (prenominal adjectives, prepositional phrases, participial phrases, and participles), as well as the highest percentage of relative clauses which are the least deeply embedded of the modification structures.

For the most part there was a wider range of variance in similar structures that appeared in each of the grade ten texts while the grade twelve texts showed the greatest degree of consistency.

## II. IMPLICATIONS

The implications that appear to be inherent in the findings of this research are discussed under two main headings.

### 1. Readability

The immediate object of this research was not to develop another readability formula. This was an exploratory study and the basic aim was a clearer understanding of a specific factor, that of sentence complexity, which makes for difficulty in understanding the content of textbooks. In order to accomplish this aim a linguistic technique developed by Chomsky was utilized. However, the result of this investigation suggests a number of implications for the direction that future readability research may take.



Research in readability has shown that sentence length is a contributor to difficulty in understanding written discourse. In this study only one syntactic area that contributes to sentence length, that of noun modification, was examined. It has been shown that at least ten different syntactic patterns may be used to express noun modification. There is variation in these patterns in terms of length, complexity, position, and frequency of occurrence. It would appear that even on one level, that of syntax, language is an extremely complex phenomenon. In view of this finding it would seem that predicting difficulty of written discourse by average sentence length is perhaps too unsophisticated a procedure to yield valid results. What gains in over-all prediction could be achieved if lists of syntactic patterns were compiled for inclusion in formulae?

The linguistic technique employed in this study is time-consuming and laborious and its usefulness might be questioned on practical grounds. However, a grammar of the generative form lends itself to storage and conversion to computer programs. Successful programs have been developed for searching documents and recording information. A necessary requirement is the preliminary linguistic analysis of the data to be processed. After raw text and grammar rules are compiled in the system, the computer can perform automatic analysis and frequency counts.

In readability formulae the problem of sampling reliability is an important one. No evidence is available on the size of sample that would yield the most consistent results in the shortest time.







However, if analysis and frequency counts are carried out by computer the complete text could be processed and sampling adequacy need no longer be of concern to investigators in the field of readability.

There are other aspects of the problem of sentence complexity other than the one presented in this study. The analysis presented in this study has considered the sentence as a separate entity in written discourse. Young and Becker<sup>1</sup> point out that a complete description of sentences in a text should include a specification of their distribution in paragraphs and other larger units of discourse. They note:

As the linguist moves beyond the sentence, he finds himself asking questions which have long concerned rhetoricians. The description of the structure of a sentence and the description of the structure of an expository paragraph, extended argument, or novel are not sharply different kinds of activity, for all involve selecting and ordering language in a significant way. The traditional separation of grammar, logic, rhetoric, and poetics begins to break down.<sup>2</sup>

The extension of grammatical analysis beyond sentence boundaries in order to describe how the sentences of a coherent discourse interconnect and interrelate to carry the information that the discourse conveys might be a rewarding and fruitful investigation.

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<sup>1</sup>Richard E. Young and Alton L. Becker, "Toward a Modern Theory of Rhetoric: A Tagmemic Contribution," Harvard Educational Review, XXXIV (Spring, 1964), 456.

<sup>2</sup>Ibid.



The results might furnish some new perspectives on the problem of determining ease or difficulty of written material and suggest that the development of readability formulae may proceed in completely new directions.

## 2. Further aids to comprehension

All of the foregoing implications have been concerned with sentence complexity in textbooks. However regardless of the refinement that can be given to textbooks in terms of readability levels there may be further steps that can be taken in order to ensure the comprehension of written discourse.

Chomsky's theory of a transformational grammar was selected for this study because it is a system which reveals and expresses in an explicit way the regularities which underlie the language. Would a knowledge of this form of grammar assist the student who must utilize the textbook?

The introduction of this type of grammar into the schools has been objected to on the grounds that it is too complicated for students. However it is Bruner's hypothesis that "any subject can be taught effectively in some intellectually honest form to any child at any stage of development."<sup>3</sup> This hypothesis has been accepted by some educators since a number of transformation grammar programs have

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<sup>3</sup>Jerome S. Bruner. The Process of Education (Cambridge, Mass.: Harvard University Press, 1961), p. 33.







been introduced into elementary and high school curricula.

Bruner also stresses "the complementary nature of intuitive and analytic thinking."<sup>4</sup> Transformational grammar emphasizes the fact that users of the language have an intuitive knowledge of the language. By this is meant that language users can produce novel sentences, recognize ambiguities and other language phenomena without necessarily understanding the rational basis for their competence. Since a transformation grammar provides an analytic technique whereby the underlying structure of language is demonstrated is it possible that emphasis upon the deep and the surface structure of the language would increase facility in intuitive thinking about language?

This approach to the language would perhaps be best instigated through serious intellectual inquiry on the part of the student. The teacher would guide the student to a conscious awareness of some of the facts of language that the student possesses. A student could be brought to inquire about what Chomsky calls "levels of grammaticalness."<sup>5</sup> Chomsky points out that while some sequences of words are clearly grammatical sentences, others clearly are not. There are many, however, that seem to fall between clear grammaticalness and clear ungrammaticalness.<sup>6</sup> Could a grammar that is explicit in its

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<sup>4</sup>Ibid., p. 58.

<sup>5</sup>Noam Chomsky, Syntactic Structures (The Hague: Mouton and Company, 1957), p. 42.

<sup>6</sup>Ibid., pp. 42-43.



formulation assist the student to determine for himself how a sentence deviates from well-formedness and allow him to examine and investigate the concept of grammaticalness?

Is it possible that the application of transformational grammar can be utilized in the teaching of precis writing? Since modification elongates a sentence, a knowledge of how to shorten sentences by deeper embeddings or complete modification cuts might aid students in condensing articles.

Transformational grammar might be an excellent device for attacking prose style. For example, Hemingway, in the opening paragraph of "A Farewell to Arms" makes effective use of coordination to create certain tensions in meanings. Coordination is a syntactic device that helps writers to avoid repetition and redundancy and to achieve parallelism or balance in structure. A transformational analysis shows explicitly how this is achieved. A further examination of the work of Hemingway would reveal whether coordination is characteristic of Hemingway's style.

It is also possible that a generative-transformational grammar could be used to determine the kinds of syntactic deviation which frequently characterize poetic language. In poetic analysis emphasis is often placed on a poet's choice of words. However words exist within sentences and it might be particularly interesting to use the transformational technique to explore the syntactic oddities of such poets as e.e. Cummings and Dylan Thomas.







It would appear that a study of language and literature along the lines suggested might provide new and valuable dimensions in which to consider a number of problems relating to comprehension of written discourse.

### III. RECOMMENDATIONS FOR RESEARCH

The results of this study provides some interesting possibilities for future research. The following studies are suggested:

1. An investigation to determine the ability of high school students to cope with noun modification structures in social studies materials. The ease or difficulty of the various patterns of modification could be determined by developing series of reading passages with each passage being heavily weighted with one of the ten modification units. The criterion of difficulty would consist of comprehension questions on each passage and significant differences found between the comprehension scores on the passages varying in structure.

2. Studies to determine and quantify other types of structural elements that are present in high school social studies texts.

3. A study to determine what syntactic patterns are present in mathematics, literature and other types of texts.

4. A study to develop a readability formula that would include patterns of syntax as predictors of difficulty. Investigations along this line might have to consider the feasibility of developing different formulae for various kinds of texts.



5. An investigation to determine if knowledge of grammatical structures present in texts contributes to comprehension of texts.

6. An investigation to determine the effect of grammatical complexity in terms of depth of embedding on comprehension.

7. Any number of investigations could be carried out that would utilize Chomsky's theory of grammar to examine the style of various writers and poets.

#### CONCLUDING STATEMENT

This research has been concerned with utilizing a special linguistic technique in order to examine sentence complexity in high school textbooks. The approach has been exploratory in nature and consisted of investigating the frequency of certain patterns of language structure associated with noun modification. These structures and the relationship that exists among them were defined in terms of Chomsky's theory of transformational grammar.

It would appear that the application of this technique for further study of grammatical complexity in various types of texts could lead to a development of a general readability formula that could be applied to any type of text or to a series of readability formulae that would be used with different kinds of texts. In addition it would appear that this form of grammar could make considerable contributions to the teaching of English and in helping students to comprehend written discourse.





Adolescents are in the midst of a vital knowledge boom prompted by advanced scientific discovery. Research and classroom instruction that will provide the student with appropriate materials and skills to cope with this knowledge are goals worthy of continued attention.



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## Appendix 1: Summary of the 10 most common types of business failure

The following table shows the 10 most common types of business failure, based on the number of businesses that have failed in the last 10 years. The table is based on data from the Insolvency Service, which is the government department responsible for dealing with business failures.

There are many reasons why businesses fail, but the most common ones are listed in the table below. The table is based on data from the Insolvency Service, which is the government department responsible for dealing with business failures.

### Appendix 1: Summary of the 10 most common types of business failure

There are many reasons why businesses fail, but the most common ones are listed in the table below. The table is based on data from the Insolvency Service, which is the government department responsible for dealing with business failures.

1. Lack of capital

2. Poor management

3. Poor timing

4. Poor marketing

5. Poor location

6. Poor product

7. Poor service

8. Poor customer service

9. Poor reputation

10. Poor timing

11. Poor timing





## TYPES OF SYMBOLS IN A TRANSFORMATIONAL-GENERATIVE GRAMMAR

The symbols for a set of rules in a transformation grammar may be arbitrarily chosen. But wherever possible they are chosen for their mnemonic value.

There are three basic types of symbols in the grammar. They are (1) vocabulary symbols, (2) operators, and (3) abbreviators. The symbols listed below are taken from Koutsoudas.<sup>1</sup>

### 1. Vocabulary symbols

There are two types of vocabulary symbols; non-terminal symbols which represent class symbols and terminal symbols which represent morphemes. Examples of class symbols are listed below. A subscript can be added to a symbol to denote a subclass, e.g. the symbol  $N_h$  denotes 'noun human'.

A, Adj = Adjective

Acc = Accusative

Adv = Adverb

Afa = Adjective affix

Afn = Noun affix

Afv = Verb affix

As = Adjective stem

Aux = Auxiliary phrase

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<sup>1</sup>Andreas Koutsoudas. A Beginner's Manual for Writing Transformational Grammars (Preliminary Edition, Indiana: Indiana University, 1964), pp. 3-16.



D, De, Det = Determiner (i.e. articles, demonstratives, numerals etc.)

F = Feminine

M = Modal

N = Noun

Na = Nasal

Neg = Negative

NP = Noun Phrase

Ns = Noun stem

Nu = Number

Pas = Past tense

Per = Person

Pl = Plural

PP = Prepositional phrase

PPa = Past participle

Pr, Pron = Pronoun

Pred = Predicate adjective or noun

Prep = Preposition

Pres = Present tense

Pt, Prt = Particle

S = Sentence

Sg = Singular

Tm = Time adverb or phrase

V, Vb = Verb

VP = Verb Phrase





The morpheme symbols are vocabulary elements, e.g. boy, came, which can be carried by morphophonemic rules into the elements / bój/, / kéym/

## 2. Operators

The plus sign or the arch, +  $\frown$ , serve as boundary markers and concatenation symbols. They indicate the operation of concatenation, i.e. that the elements bounded by the plus or arch are related and their relation is that one follows or precedes the other, e.g. in the rule  $X \rightarrow Y + Z$  the plus sign indicates that Z follows Y and Y precedes Z.

The double cross, #, is also a concatenator and serves as a sentence or word boundary. It is used to indicate the beginning and ending of a word or sentence.

An arrow,  $\rightarrow$  is used to indicate the operation of rewriting. In the rule  $A \rightarrow B + C$ , the string indicates that the string on the left is to be rewritten as the string on the right. A double arrow identifies a rule as being a transformational rule, e.g.  $Af + v \rightarrow v + Af$

## 3. Abbreviators

Abbreviative devices are used to collapse several rules into one.

Parentheses, ( ), are used to enclose optionally chosen items. For example, the two rules,  $A \rightarrow B$  and  $A \rightarrow B + C$  specify that both B and B + C have the structure A and therefore the selection of C with



B when rewriting A is optional. These two rules can be conflated or abbreviated as follows:  $A \rightarrow B(C)$ . This means that in rewriting A, B must be selected but the selection of C is optional.

Paired braces,  $\{ \}$ , are used to conflate two or more rules that contain mutually exclusive alternative replacements for the same symbol. For example, the rules  $A \rightarrow B$ ,  $A \rightarrow C$ ,  $A \rightarrow D$  may be conflated to  $A \rightarrow \begin{Bmatrix} B \\ C \\ D \end{Bmatrix}$ . The rule states that only one of B, C, or D may be selected at any given application of the rule.

Paired square brackets,  $[ ]$ , are used to abbreviate the listing of rules in which different symbols are replaced in the same environment. At least two pairs of brackets must appear, one of which is to the left of the arrow. The conflated rules are read across by rows. For example, the rule  $\begin{bmatrix} A \\ B \end{bmatrix} C \rightarrow \begin{bmatrix} D \\ E \end{bmatrix} C$  conflates the two rules  $A + C = D + C$  and  $B + C = E + C$ .

Cover symbols, usually the last three or four letters of the alphabet, are used to abbreviate parts of a rule; a cover symbol may be used an unlimited number of times in a grammar, but may have only one value in each rule, and each time it is used, its value must be defined in a note below and to the right of the rule. For example, in the rule  $\text{Tob } X + D + E \Rightarrow D + E$ , where X = any string, the use of X obviates the necessity of listing every string that occurs before D + E.







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